22 SEPTEMBER 1961

METAL INDUSTRY

THE JOURNAL OF NON-FERROUS METALS

VOL 99 No 12 ONE SHILLING

Verb sap!

* Joe worked an old No. 12! The castings he produced were the best in the trade. Unfortunately Joe left and was replaced by a succession of operators each trying to get castings as good as Joe's! In desperation a new No. 12A was installed, with the result that *any* operator can now get perfectly good castings *much, much faster* than Joe.

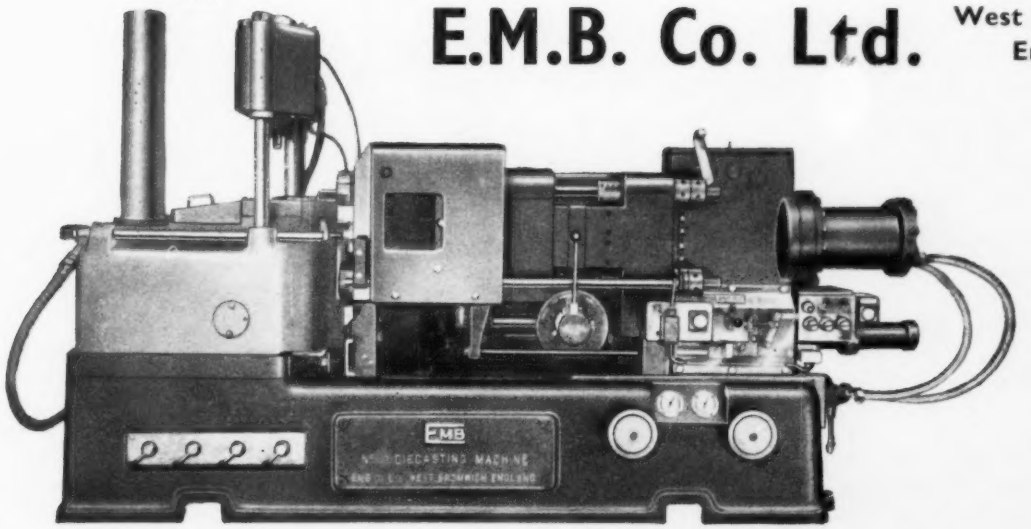
Verb sap!

* A true story with the name changed.

Capacities:

Machine ...	6	10	12A	16	20A
Zinc lbs. ...	½	2½	6·3	13·6	25·7
Alum lbs. ...	—	1½	2·1	4·5	—
Max. die ...	8½ × 9½	16 × 10	20 × 12½	28½ × 16½	35½ × 19½
Platen stroke	4½	6	8	11	13

E.M.B. Co. Ltd. West Bromwich England



A

QUALITY...

UNIFORM

Intensive Research and Quality Control ensure that you can depend on the uniformity of

Unceasing research and strict quality control, at all stages of production, ensures that Intal Light Alloy Ingots can always be depended upon. The quality never varies. With over a quarter of a century's experience and progress, Intal maintain all the newest techniques in scientific inspection, and make use of the most advanced instrumentation in ensuring that the Intal high standard of quality is consistently maintained.

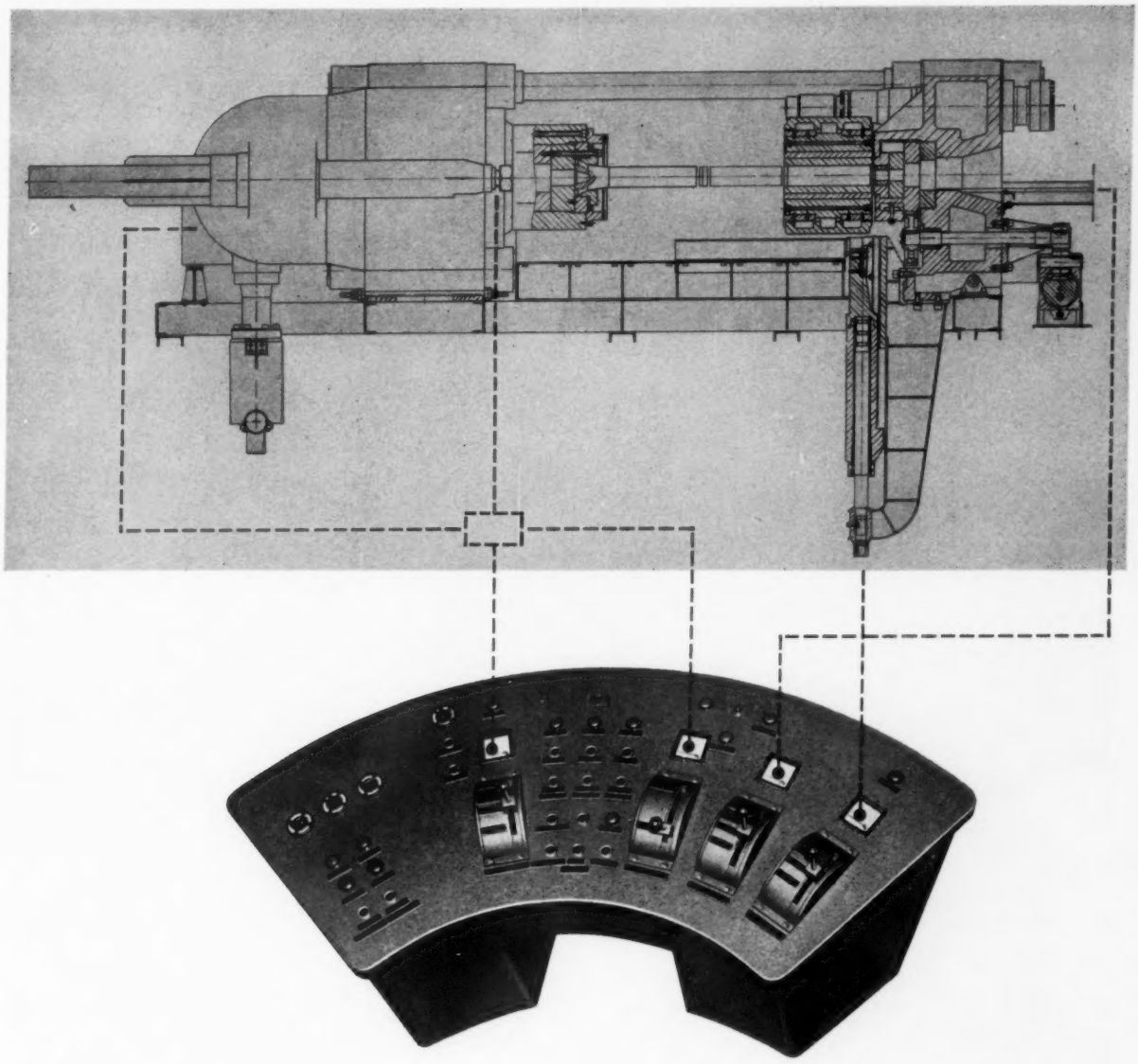
INTAL

Light Alloy Ingots

These illustrations are taken from the latest Intal booklet, giving much interesting information on alloy ingot manufacture. We shall be pleased to post a copy to executives on request.

INTERNATIONAL ALLOYS LTD

HAYDON HILL, AYLESBURY, BUCKS. Telephone: Aylesbury 4242. Telex. 83120 Cables: Intalloyd, Aylesbury.



Fully Automatic
Extrusion Presses require highly developed control systems!

There is no doubt: Automation in connection with rod and tube extrusion presses imposes a further development of the controls. The illustration shows how LINDEMANN have solved this problem by means of the electro-hydraulic control.

The control desk shown above allows for alternate combination of the press with the various auxiliary devices in order to cope with the different extrusion methods. The modern lever control acting as potentiometer impulses ensures shortest switch-over times and safer operation. The sensitive electro-hydraulic speed control considerably improves metallurgical properties, surface quality, tolerance of the extruded products, and the productive capacity of the press.

You will certainly be interested in further details on the design, working method, and control of the all-automatic LINDEMANN-LAKE ERIE Extrusion Presses.

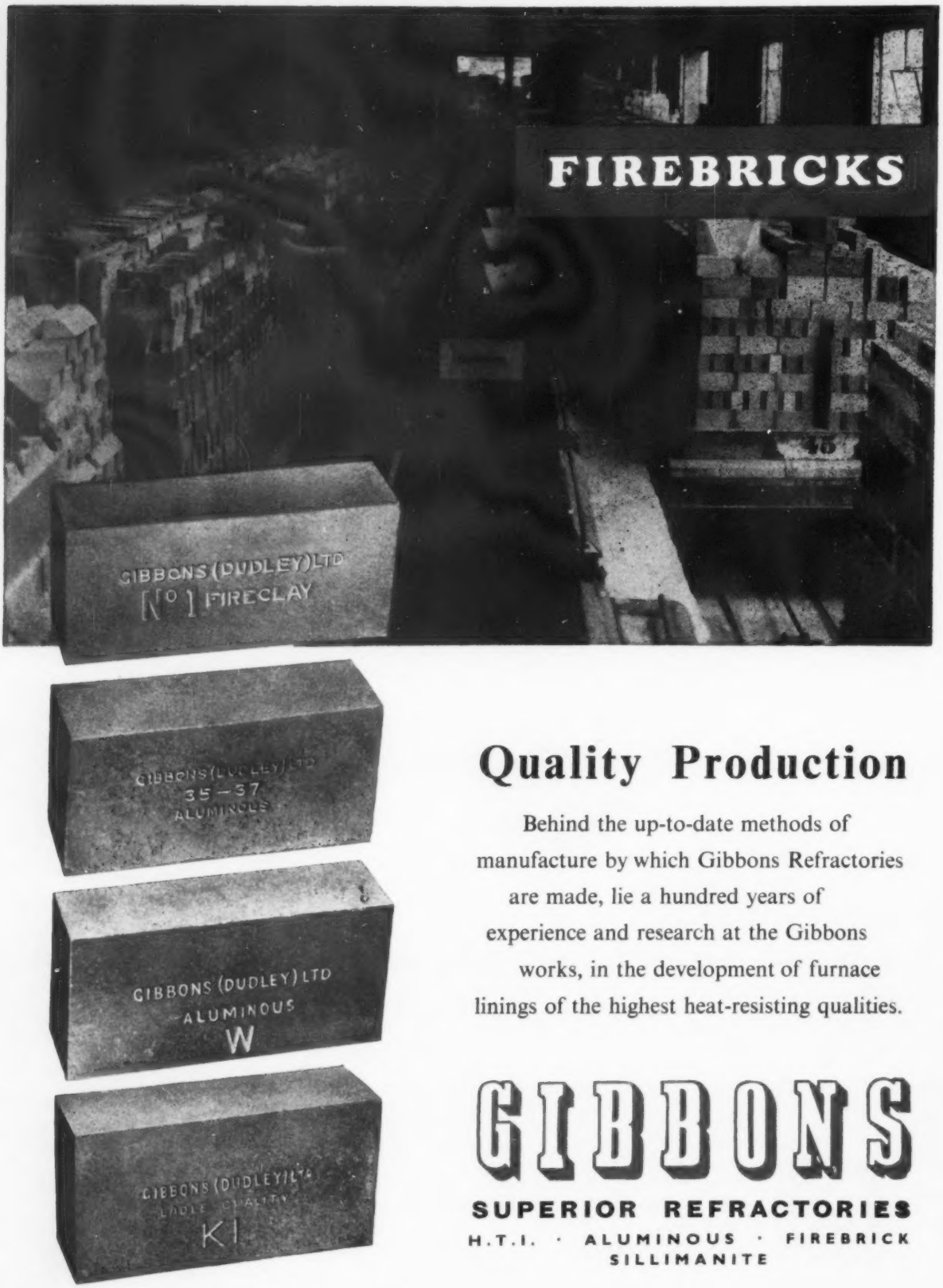
Please write to:

LINDEMANN - Kommanditgesellschaft · Düsseldorf · Germany

Our Agents in the British Isles: **MOFFAT & BELL LTD.** 83, Pall Mall, London S.W.1 Telephone: Whitehall 4038

and at 466 Royal Exchange, Manchester 2—Telephone: Deansgate 5131

A*



Quality Production

Behind the up-to-date methods of manufacture by which Gibbons Refractories are made, lie a hundred years of experience and research at the Gibbons works, in the development of furnace linings of the highest heat-resisting qualities.

GIBBONS

SUPERIOR REFRACTORIES

H.T.I. · ALUMINOUS · FIREBRICK
SILLIMANITE

Gibbons (Dudley) Ltd., Dibdale Works, Dudley, Worcs.

H-W.188

starting something?

starting something? . . . where more pairs of skilled hands (and trained minds, too) could be useful . . . where extra Design facilities would relieve the pressure on the Drawing Office — or where, without capital expenditure, you would like to augment your own resources with additional Production of a specialised nature.

Then consult The Pickering Group, and join the many diversified industries that are using the technical knowledge and experience of this efficient consortium of Scottish companies. Here, the traditional engineering skills of almost a hundred years are merged with the *Advanced Techniques of the Twentieth Century — techniques in the Application of High Vacuum Principles to Industrial problems* — the provision of Complete Off-Shore Oil Drilling Equipment — the Fabrication of Engine Bedplates, Gearboxes, Cranes and Tanks . . . and the building of High Vacuum Units for Decorative Finishes and Optical Coatings. Even in the High Vacuum aspects of Space Research, The Pickering Group has something to offer. Your enquiries will be referred to the appropriate Technical Consultant Panel and if the job comes within the scope of The Group's activities work can be undertaken on a contract or sub-contract basis. Exploratory enquiries incur no obligation.

HIGH VACUUM EQUIPMENT For Decorative finishes and Optical coating	**HIGH VACUUM FURNACES** For Melting and Sintering
IONIZATION CHAMBERS	**CONTROLLED ATMOSPHERIC WELDING EQUIPMENT**
HIGH VACUUM GAUGE UNITS	
HIGH VACUUM VALVES AND ACCESSORIES	**FREEZE DRYING AND DEHYDRATION PLANT**
MASS SPECTROMETER LEAK DETECTORS	**DIFFUSION PUMPS**
IMPREGNATION AND ENCAPSULATION EQUIPMENT	**ALPHA RAY IONIZATION GAUGE CONTROLS**

THE PICKERING GROUP OF COMPANIES

SERVING INDUSTRY IN MANY FIELDS — THE PICKERING GROUP OF COMPANIES — WISHAW · LANARKSHIRE

R. Y. PICKERING & CO. LTD. — Steel Fabrications - Stern Frames - Engine Bedplates - Gearboxes - Crane Structures - Tank Work - Equipment for the Oil Industry.

VACUUM INDUSTRIAL APPLICATIONS LTD. — High Vacuum Equipment - Melting and Sintering Furnaces Metal Evaporation Units - Vacuum Casting Plant - Control Equipment, etc., etc.

DANIEL VARNEY LTD. — Scientific Instruments.

WOODFIELD PICKERING LTD. — Complete Off-Shore Oil Drilling Equipment.

NETHERTON ROAD · WISHAW · LANARKSHIRE · SCOTLAND

TELEPHONE : WISHAW 2142 — TELEGRAMS : PICKERING, WISHAW

DOING WHAT COMES NATURALLY

Extracting honey is his life-work, but he does not have to learn his trade—it just comes naturally! Platt's certainly had to learn their trade, but they have been doing it for so long—manufacturing **brass, bronze, gunmetal, zinc and lead alloys**—that it now comes natural to them to give consistent purity and meticulous specifications. It's a honey of a solution to any problems involving the use of non-ferrous metals, to consult Platt's. Their advice may save expensive trial-and-error methods, and their prices are so keen they will astonish you.

Platt
METALS LTD

PLATT METALS LTD. ENFIELD, MIDDLESEX. PHONE HOWARD 3351 TELEX 25212

METAL INDUSTRY

FOUNDED 1909

22 September 1961 Volume 99 Number 12

CONTENTS

PUBLISHED EVERY FRIDAY BY ILIFFE PRODUCTION PUBLICATIONS LTD.
Editorial Offices: 9 Charlotte Street, Birmingham 3. Telephone: Central 3206

Advertising and Publishing Offices: Dorset House, Stamford Street, London, S.E.1.
Tel.: Waterloo 3333. 'Grams: "Metustry, London-S.E.1"

Branch Offices: MANCHESTER: 260 DEANSGATE, 3; telephone, Blackfriars 4412 and Deansgate 3595
BIRMINGHAM: KING EDWARD HOUSE, NEW STREET, 2; telephone, Midland 7191. COVENTRY: 8-10 CORPORATION STREET; telephone, Coventry 25210. GLASGOW: 62 BUCHANAN STREET C.1 telephone, Central 1265/6

Annual Subscription
HOME £3 7s. 6d.
OVERSEAS £3 12s. 0d.
CANADA AND U.S.A. $10.00
Including one copy of Metal Industry Handbook *Published Annually*

METAL INDUSTRY

22 SEPTEMBER 1961

VOLUME 99

NUMBER 12

Anodizing Today—and Tomorrow

FOR the first time in this country, producers, anodizers and users of anodized aluminium met last week to discuss their mutual problems and air a few of their grievances. Some 270 delegates attended a conference at Nottingham University, organized by the Aluminium Development Association, which emphasized still further the need, which arises in this field as it has in many other older industries, for all concerned to work in closer co-operation than hitherto on technical problems, on the maintenance of quality, and towards a wider appreciation of the advantages and limitations of the process. Clearly, from the points of criticism arising from users, there have been occasions when anodized aluminium has been applied in unsuitable situations, with insufficient knowledge, or with a lack of attention to its special characteristics. If such criticism is to be satisfactorily met in the future, much will have to be done to avoid repetition of these occurrences and if the conference does no more than make all concerned aware of this danger it will have proved effective.

It will, of course, achieve much more. Technical problems and differences of opinion were discussed in and out of sessions—the value of the Gardam grid as a general brightness test, the relative merits of the overall assessment made by the human eye and that made by instruments which usually measure the specularity of a single spot, the advantages of different processes and sealing methods, the minimum film thicknesses required for satisfactory corrosion protection. All this exchange of opinion and experience must prove of the utmost value. Even more significant was the request put forward by several delegates for the formation of a joint panel on research to enable the producer, anodizer and user to work together and to avoid duplication of research work. Several speakers deplored the lack of uniformity in what is loosely termed "anodizing quality" material. Mechanical polishing came under criticism and improvements were looked for in liquid and "wet" polishing, as well as in electrobrightening and chemical brightening.

On the application side, there seemed to be a growing field for the use of 99·8 per cent purity material as compared with super purity, and in the electrical industry wider use was being made of anodized wire and strip. In architecture, the problem of colour matching of curtain walling panels was acute, as also was that of obtaining satisfactory corrosion resistance in view of the difficulties involved in the maintenance of high buildings and the attack of industrial atmospheres.

From all this there emerges a clear impression of an industrial process that has emerged from infancy to adolescence — with the difficulties such an emergence involves. With the greater co-ordination of effort that seems likely to ensue from this conference, there should be every reason to look forward to an increasing—and, what is more important, even more successful—range of applications for anodized aluminium in the future.

Melting Aluminium Bronze and Hardener Alloys

EQUIPMENT AND METHODS USED IN THE PRODUCTION OF RANGE OF SPECIAL ALLOYS

DEVOTED to the production and working of aluminium bronzes, nickel-silicon bronzes, chromium copper alloys, aluminium alloys, high nickel alloys, high melting point, rich and hardener alloys, the production shops of N. C. Ashton Ltd., of Huddersfield, consist of melting shop, foundry, forge, ring rolling, heat-treatment and machine shops. In addition, there are a number of quality control units such as chemical and physical laboratories, and the usual works services including transport.

Other types of material are made to order and delivered in the finished form required by the customer.

The main categories of these metals is suggested by the melting shop being laid out so as to constitute two separate sections, viz., the oil-fired furnaces for the production of the billets and ingots, principally in aluminium bronzes; and the electric high frequency furnaces for the production of the high-melting-point, rich and hardener alloys.

Melting Shop

The three oil-burning furnaces are fully rotary, creosote-pitch-fired and each has a capacity of 3,600 lb. of aluminium bronze and operates usually up to 1,200°C. They have been especially designed for the melting of aluminium bronzes. An open flame is delivered direct on to the melt, forced air being used. This oxidizing condition minimizes gas pick-up.

Furnaces Nos. 1 and 3 are used for two types of production:

(a) Extrusion or forging billets in haematite moulds by a tilting method, producing round billets 4 in. to 11½ in. in diameter.

(b) Chilled mould ingots for foundry use.

Furnace No. 2 also has two types of production:

(a) Chilled mould ingots.

(b) Large round billets by the tilting method—13 in. diameter up to 1,600 lb.; 16 in. diameter up to 3,000 lb.; 20 in. diameter up to 4,800 lb.

In a typical case, an aluminium bronze would melt at 1,080°-1,100°C., a heat taking approximately 2 hr. from the start of the charge to the finish of pouring. The raw material in such a case is high purity ingot copper and ingot aluminium, or aluminium bronze scrap. A commonly used flux would be Albral No. 2 but it is not applied as a complete cover as would be the case with a crucible, but in small quantities to reduce oxides to dry dross which can then be removed by raking.

The pouring technique is a semi-Durville process and special equipment has been designed for it. A track over a pit runs along the front of the furnaces, at each of which are stationed two carriages, one on either hand so that they may be used alternately. Each carriage contains the following components:

(a) A tilting cradle incorporating a clamp for holding the mould, pivoted adjacent to the side of the mould accepting the poured metal and mounted at the front end of the carriage.

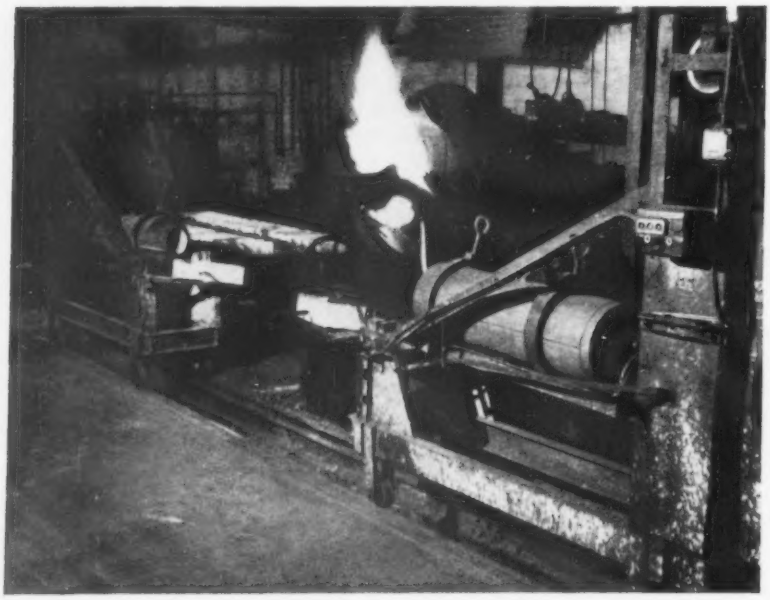
(b) A hoist unit for tilting the mould cradle, consisting of a motorized winch driven through an infinitely variable hydraulic transmission housed in a casing at the rear of the carriage, but controlled by a lever at the front or pouring end.

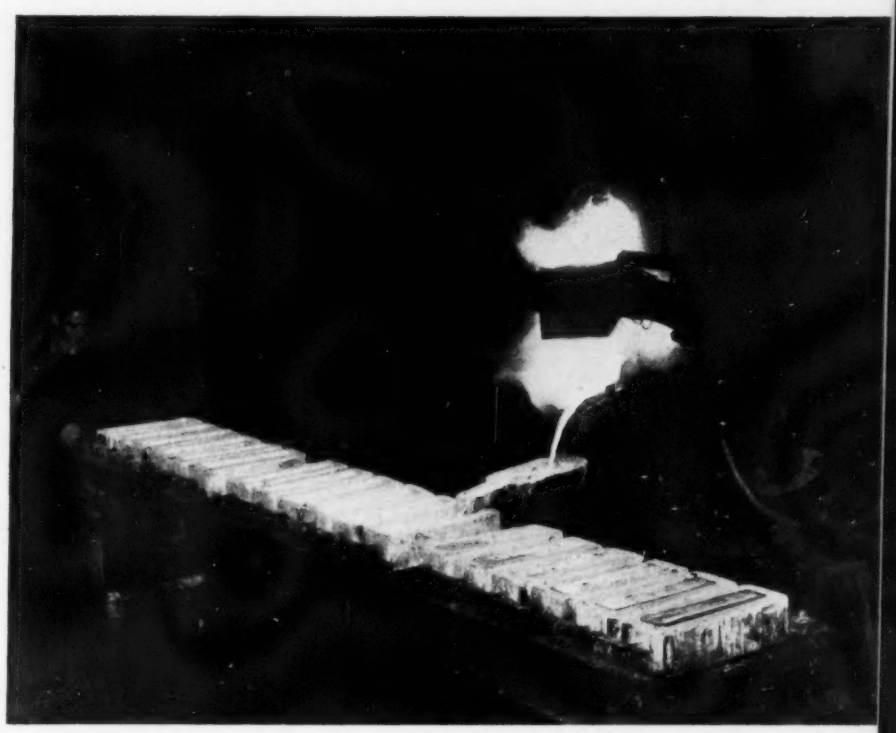
(c) A runner box or launder erected on a swinging arm at the front end of the carriage so that it is capable of feeding the mould mounted in the carriage, while receiving metal from the furnace.

The operation of the furnace and mould carriage involves a well co-ordinated series of steps during pouring. The furnace is lifted from the rear by a hoist until the metal bath is almost pouring through the lip. At the same time, the mould is tilted in the carriage into a horizontal position and the feeder box (launder) swung so that the side outlet is inside the mould top and the dished portion under the furnace lip. As the furnace tilts, the metal pours into the launder and from the launder into the mould, which is then slowly lowered from a horizontal to a vertical position. As a result, the metal flows down the wall of the mould with the minimum drop at any stage of the process so as to reduce turbulence to the absolute minimum.

The runner box design has also been developed partly with the same objective and partly to ensure trapping of dross. The metal turbulence is limited to one point only; where it falls from

General view of rotary furnace showing billet casting machines





Pouring ingots from one of the rotary furnaces

the furnace lip into the launder dish. In addition, a right-angle bend is incorporated in the flow route in the launder before it reaches the side delivery lip which itself is a weir; these features help to retain dross in the dished part of the runner box. The launder side delivery lip is in $\frac{1}{4}$ in. thick heat-resisting steel, while the dished portion has a refractory lining.

The moulds are in haematite iron 4 in. to 20 in. in diameter, coated with a suspension of ground bone ash in water.

A considerable amount of development work has been carried out to establish the right kind of feeder head for these moulds. At one time the practice was to use a fireclay head together with an exothermic powder sprinkled on top of the molten metal. When the mould was vertical at the end of the pouring and the exothermic powder placed on top it was found that bridging by the solidifying metal occurred just below the feeder head and above the hot spot on the mould side which arose from the method of pouring down the side to avoid turbulence. The research at N. C. Ashton on this subject aimed at the following objectives: (a) moving the hot spot from the ingot side by pouring into the header; (b) to secure better insulation properties in the header to prevent thermal wastage; (c) to ensure the metal in the header stays liquid longer than that in the top of the ingot so as to avoid the bridging.

The procedure in solving these problems was to deal with: (a) the design of the header; (b) the relative solidification time of header and ingot.

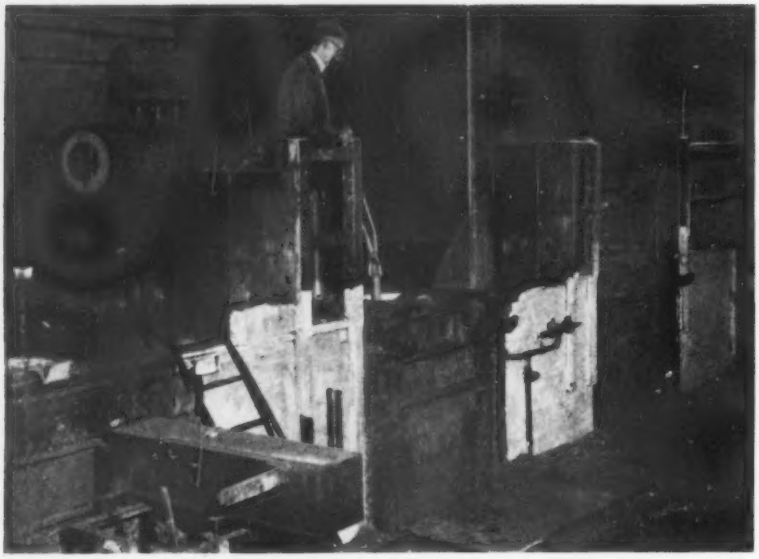
As a result of a considerable number of experiments, the inner sleeve and the outer casing ("tea cosy") for the header were standardized.

The inner sleeve consists of heat-resisting stainless steel in a thin shell of 18G material, tapered for ease of removal, fitted with welded lugs to prevent it falling into the mould and having two holes for receiving a tommy bar to assist its removal. This thin shell is coated with the bone-ash-water mixture.

The outer casing, or tea cosy, consists of a hollow ring with $\frac{1}{2}$ in. to $\frac{3}{4}$ in. between the walls filled with asbestos wool, the outer wall being in 20G mild steel and the inner in 18G heat-resisting stainless steel. The top and bottom are closed by mild steel, crimped and turned over to retain the filling. This ring fits loosely over the inner sleeve, leaving a gap of $\frac{1}{8}$ in. or so of still air. The inner sleeve, when in position, is inserted several inches into the mould but the outer casing, or tea cosy, sits on the top of the mould with the inner sleeve projecting through it. It is apparent that the inner sleeve gives mechanical strength for accepting the pouring of the molten metal and it is as thin as possible so as not to absorb the heat. The outer casing, or tea cosy, is the thermal insulator.

The header is attached to the mould before pouring so that the molten metal flows over the header inner sleeve into the mould. When the mould is full in the vertical position, the pouring

Inserting fabricated feeding head in billet mould prior to casting



General view of electric high frequency furnaces

continues until the header is also full; then the exothermic powder (Feedex No. 4) is scattered on top.

The experiments aimed at obtaining a sound billet by avoiding bridging involved ascertaining the procedure which would enable the metal in the feeding head to remain liquid until after solidification in the mould.

This research was carried out for a particular size of $6\frac{1}{4}$ in. diameter, and it was discovered that in this case solidification in the mould took $11\frac{1}{4}$ min. As a result, it was determined to arrange the design of the feeding head and exothermic procedure so that the metal in the feeder remained liquid for 15 min., and the equipment and process described above have achieved this result. During the research investigations a mould was drilled so that a thermocouple could be inserted 3 in. down from the top of the mould enabling temperature readings to be made unaffected by extraneous heat loss effects. Thermocouple readings were also made in the feeder head and these calibrated against time readings so as to give the relative solidification rates in the feeder and the billet respectively. By this specially designed plant the company has been able to ensure a very strict system of quality control of the billets produced.

The furnaces are so designed that they may be rotated and tilted. Each consists of a mild steel horizontal barrel incorporating a gear at the rear cut in an annular ring. This meshes with a pinion mounted in a floor housing driven by a two-speed motor through a reduction gearbox in such a way that it rotates the furnace when power is switched on by push-button control. Round the centre of the barrel is a running track which acts as a bearing for the moving weight of the apparatus by resting on two idler rollers on the bedplate. To provide for tilting, the forepart of the barrel carries a projecting wedge which, when the barrel is tilted, rides on a pivot block on the bedplate, the rear of the barrel being lifted by an overhead motorized hoist on furnace No. 3 and by hand winches on Nos. 1 and 2.

The furnace lining is in 32 per cent alumina firebrick laid as one course, backed by a course of insulation bricks of frothed fireclay. In melting aluminium bronze there is no slagging of the furnace lining, but instead a build-up is formed of copper oxide and alumina. In time, this reduces furnace capacity and has to be removed mechanically, which operation is the principal cause of damage to the furnace brickwork. Re-bricking is only called for after some 2,000 heats.

The oil-fired burners are located on a burner plate external to the furnace shell. For each there is a single burner supplied by Nu-way Heating Plants Ltd. These receive fuel by a gravity feed through a needle valve control and forced air is provided by a 5 h.p. motorized fan with butterfly controls for primary and secondary air, the former being connected to the incoming fuel and the latter to the flame. The path of the flame has been very carefully studied, so that it follows a course similar to a horizontal "U", entering along the lower leg, which travels over the metal, and returning by the upper leg. The design of the flame path, burner and hearth are, of course, related to the process, which is designed to be oxidizing on account of the protection received by the aluminium bronze from alumina films which permit it to be heated in an oxidizing atmosphere to the melting temperature without appreciable metal loss.

Special aluminium bronzes have been developed at the Ashton works for particular applications. Examples of these under their registered trade mark are:

(1) Narrmac—a general engineering aluminium bronze to the close-controlled composition which meets D.T.D.197A.

(2) Narite—a hard aluminium bronze for press tools and deep-drawing dies.

(3) Narglas—a special alloy for glass moulding applications.

Thin plate mould to prevent segregation in hardener alloys

High Frequency Electric Melting

The portion of the melting shop set aside for H.F. electric melting is concentrated round a conventional electric melting stage on the forward edge of which are pivoted three furnace bodies, two of 5 cwt. (steel equivalent) capacity and one of 12 cwt. (steel equivalent) capacity. These are linked to two motor generator sets, respectively of 100 and 200 kW capacity, so that the three furnace shells are, in fact, operated in a cycle with two furnaces in production and one down for relining. Furnace tilting is electrically powered and controlled by hand levers and push buttons

mounted on the edge of the stage within easy reach of the operators.

Temperature readings during melting are made with the aid of platinum-rhodium pyrometers.

This equipment is applied to the production of two main types of alloy considered in general terms, viz: (a) hardeners; (b) billets in alloys unsuitable for melting in the oil-fired furnaces for various reasons such as high melting temperature.

Hardeners

Hardeners are well-known in the non-ferrous trades as a means of introducing metals of high melting point into metals of lower melting temperature. This is achieved by preparing a "hardener" alloy consisting of the high-melting-point constituent with one or more metals of much lower melting point, bringing the melting point of the "hardener" below the pouring temperature of the alloy in production.

The hardeners themselves may be visualized in two groups—copper-base and aluminium-base. The former are cast in notch plate moulds of cast iron mounted so as to rotate on racks which permit the finished notched plates to be tipped out on the floor to cool.

On the other hand, aluminium hardeners are cast in both these tilting moulds and also as flat plates in horizontal moulds measuring typically, say, 30 in × 12 in. in horizontal area and $\frac{3}{8}$ in. to $\frac{1}{2}$ in. thick, the greater surface area giving a quick chill and so reducing the incidence of segregation. In any of these alloys where the alloying element has a much higher specific gravity than aluminium, it has been found essential to achieve solidification as rapidly as possible to prevent the alloying element sinking by gravity action in the aluminium: for this purpose the very thin horizontal moulds are an advantage.

The molten metal is hand-shanked into these moulds. To protect operators during pouring, the mould stations are provided with suspended aluminium screens.

High Melting Point Alloys

Higher melting point alloy billets are cast directly from the furnace. To facilitate this, in front of the furnace staging runs a track carrying bogies on which are mounted pourer boxes with bottom stoppers adapted to feed billet moulds standing on a turntable or, alternatively, in a casting pit beneath the tracks, where they are fed from a double tundish. In all cases, metal is top-poured.

Typical Case-History

To show how the hardeners are produced, the case history of one may be examined in detail. This is the chrome-copper hardener, with 10 per cent chromium and 90 per cent copper. The high-frequency furnace rapidly brings the temperature of the copper portion of the charge to a suitable temperature for adding the chromium, about 1,500° C. After the molten copper has received the chromium charge, the whole mix is held at this temperature for some 30 min. until the chromium is evenly dispersed.

Vertical section through 9 in. diameter cast aluminium bronze billet, 38 in. long, showing top 7 in. of metal under feeding head

Special measures are taken to ensure the chromium does not segregate during pouring, which differences in freezing temperature encourage, in spite of its finely divided state and homogeneity in the furnace. These include pouring in very thin sections such as in the $\frac{3}{8}$ in. deep moulds previously mentioned which ensure a quick chill before segregation occurs.

Another advantage with this chrome-copper hardener under the Ashton conditions is that the high frequency furnaces, by bringing the metal to temperature quickly, avoid excessive oxidation. This renders unnecessary the application of deoxidants or other additives which would adversely affect the purity and electrical properties of the finished product. The end product is often 1 per cent chromium copper for electrical purposes, which is manufactured by superheating the copper to above 1,300° C.; after which the hardener is added and stirred in as quickly as possible immediately before pouring. The cleanliness of the hardener reduces the risk of dross forming, which would promote the loss of chromium during the alloying operation.

Output of hardeners from two shifts normally reaches 30 to 40 tons/week from the high frequency furnaces. The range includes chromium-copper, copper - iron - aluminium, copper - iron plus nickel, manganese or aluminium, copper-nickel and aluminium-base hardeners.

Quality Control

As already implied, a feature of the Ashton production is the quality control. Consequently, it is necessary to examine briefly the equipment and the procedure.

In the chemical laboratory, analysis is carried out by spectro-photometric methods on two machines, a Unicam SP500 and a Unicam SP600. Copper and aluminium contents are established by wet methods.

From every cast a spoon sample is taken from the bath and chill-cast, drilled and analysed. In addition, at the end of each cast of aluminium bronze a further sample and analysis are made to check the uniformity of the aluminium content. The latter constituent is controlled to remarkably fine limits, ±0·15 per cent usually, and for some purposes to an even smaller tolerance such as ±0·10 per cent. This is achieved by a special method of analysis during melting involving a bath sample being taken just prior to skimming off the dross and raising the temperature for pouring. The resultant analysis of aluminium is ready in 10 min. and of the remaining constituents in 15 min., allowing any necessary action to be taken. The close control of the aluminium content is so

(*Continued on page* 232)

Recovery of Zinc and Tin from Secondary Products

By P. M. Sullivan and D. H. Chambers

GALVANIZER'S dross and hardhead are similar in that the main impurity in both materials is iron, which is usually present with a base metal; both the iron and the base metal are constituents of an intermetallic compound. The gross composition of dross is usually about 95 to 96 per cent zinc, 3 per cent iron, and small quantities of other impurities. Products recovered from dross by the modern practice of distillation are slab zinc, zinc dust, and zinc oxide. Distillation is normally an efficient but costly method of treatment, and purity of the product does not compare with that for the best grades of primary metal.

Hard tin or hardhead is a secondary product from tin smelting, which contains crystals of $FeSn_2$ and a small quantity of free tin. Relatively pure tin metal formed in the first stage of smelting tin ore is filtered at a temperature near the melting point of tin, leaving a hardhead residue. The largest source of hardhead, however, is the second (slag) smelting stage where the tin in the first smelting slag is entirely reduced to the approximate composition, $FeSn_2$. The general practice in tin smelting is to return hardhead to the first smelting stage, when iron from $FeSn_2$ acts as a reducing agent for tin minerals in the ore. The method is effective, but it imposes a heavy recirculating load on the smelter.

Amalgam Electrolysis

The principles of amalgam electrolysis have been explained and illustrated by several previous investigators.[1-5] Mercury has a strong affinity for certain metals and will alloy with them readily to form amalgams. The same amalgams can be formed by electrodeposition into a molten mercury cathode from a solution of the appropriate salt of the metal. Solubility data are plotted in Figs. 1 and 2 for zinc,[6] tin,[7] cadmium,[8] and lead.[8,9]

Hohn[3] suggests that there are three general amalgam types:

(1) Sodium-type metals (sodium, potassium, rubidium, cæsium, calcium, strontium, barium) have a strong affinity for mercury and relatively low solubility. Amalgamation of these metals produces amalgam electrode potentials more positive than those of the pure metals.

(2) Zinc-type metals (zinc, lead, cadmium, thallium, tin, indium, bismuth) have relatively high solubility in mercury and show little difference from the pure metals in electrode potential.

(3) Iron-type metals (iron, gallium, nickel, cobalt, manganese, chromium) are apparently insoluble in mercury at low temperatures, although they can be wetted with mercury. English and German investigators generally describe iron amalgams as a dispersion. This type of amalgam has electrode potentials more negative than those of the pure metals. Actually, iron-type amalgams resist both formation and decomposition. This phenomenon is in effect an over-voltage that is exhibited both anodically and cathodically.

Mixed amalgams are found to behave according to a set of general rules also proposed by Hohn.[3]

(i) The potential of an amalgam is determined solely by its least noble component.

Fig. 1—Solubility of zinc, tin, lead and cadmium in mercury (shown as at · per cent)

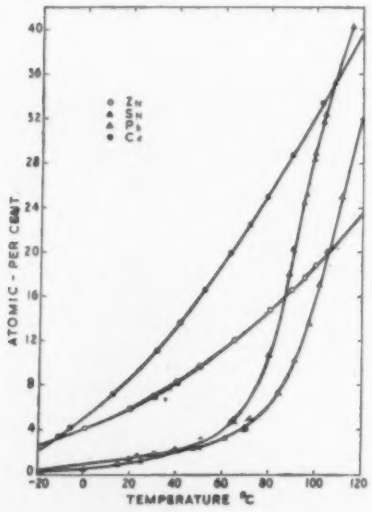


Fig. 2—Solubility of zinc, tin, lead and cadmium in mercury (shown as weight per cent)

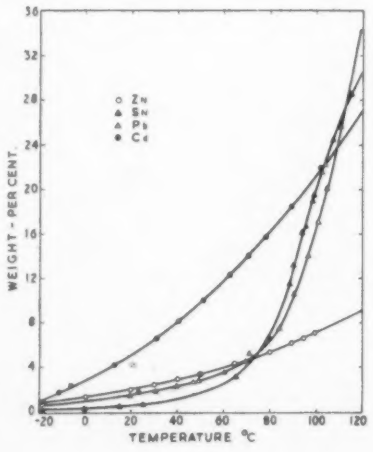


TABLE I—ANALYSES OF GALVANIZER'S DROSS

Element	Dross, weight (per cent)	
	No. 1	No. 2
Iron	3·06	3·01
Lead	1·02	1·09
Cadmium	0·14	0·098
Copper	—	0·26
Zinc	95·8	95·5

TABLE II—COMPOSITION OF ZINC REFINING ELECTROLYTE

Material	Weight (gm.)
Zinc chloride*	97·2
Ammonium chloride*	153
Glue	10
Aerosol OT (10 per cent solution)†	0·7
Water	1,000

**Molar ratio $Zn:NH_3$::1: 4*
†American Cyanamid Co.

Recovery of zinc and tin from secondary products by amalgam electrolysis has been studied at the U.S. Bureau of Mines in order to develop more efficient processing methods. Zinc of 99.99 per cent purity was recovered from galvanizer's dross with a recovery efficiency of 98 per cent. Tin of 99.9-99.99 per cent purity was recovered from hardhead with a recovery efficiency of 81 per cent. The primary advantage of this refining method lies in the direct recovery of the extremely pure base metal from highly contaminated secondary material.

(ii) Since each amalgam tends to attain a positive potential, those reactions that produce a more positive potential proceed spontaneously.

(iii) An amalgam is unable to take part in a reaction that does not change its potential.

A zinc alloy containing iron, lead and cadmium could be used to illustrate these principles. It would be readily attacked by mercury. Zinc, lead and cadmium would dissolve, and iron, being insoluble, would remain. If the saturated zinc amalgam thus formed was made anodic in an electrolytic cell, zinc would dissolve in the electrolyte. If a zinc-salt electrolyte was used, pure zinc would plate out simultaneously at the cathode. The amalgam, partly stripped of zinc, could be enriched by adding more alloy. Eventually the concentration of lead and cadmium would reach saturation, after which they could no longer dissolve and would then remain with the iron residue. Lead or cadmium in the amalgam would not take part in the electrolysis until after all of the zinc was completely stripped. The electrolyte can thus be kept from becoming contaminated by only partly stripping zinc from the amalgam and then enriching it by adding more alloy. This blocking action of the amalgam electrode makes it possible to recover very pure metal from highly contaminated metal wastes.

Experimental Procedures

The methods used for recovering both zinc and tin were essentially the same. The major differences were in cell design and in methods of pumping mercury.

Dross

Galvanizer's dross was acquired from two different sources, the chemical analyses of which are given in Table I. Both samples were nearly identical in composition and were typical of the drosses generated in current galvanizing operations. A schematic diagram of the zinc recovery system is shown in Fig. 3. The electrolytic cell with vertical electrodes is shown in Fig. 4.

The sequence of operations is as follows: (1) leaching zinc from dross with spent amalgam; (2) electrolytic refining of pure zinc from the impure amalgam, and (3) recovery of mercury from insoluble sludge residues left after leaching.

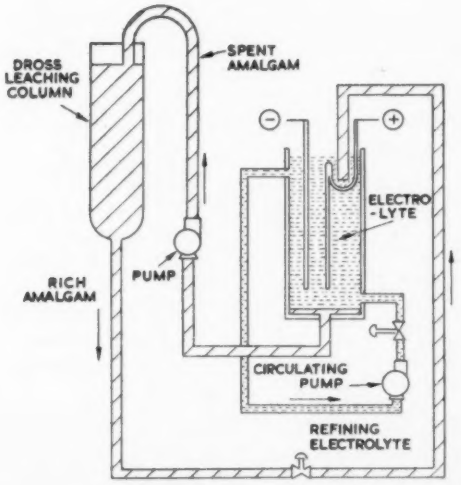
Pieces of dross, approximately 1 in. cubes, were charged to the column and leached free of zinc by passing spent amalgam over them. Zinc-rich amalgam containing soluble impurities such as lead and cadmium flowed from the bottom of the column to a refining cell, where it cascaded down the face of a galvanized iron anode plate. The sludge, being lighter than mercury, rose to the top of the mercury-leach column, where it was skimmed off. Amalgam was partly stripped of zinc anodically; a corresponding quantity of pure zinc was deposited on the aluminium cathode. Amalgam that collected in the bottom of the cell was pumped back to the top of the leaching column by a rubber-lined eccentric-type pump.

Observations made during leaching indicated that the zinc contained in $FeZn_7$ did not dissolve until the free-zinc matrix was completely leached. This statement was true so long as the amalgam was kept near saturation. After free zinc was entirely leached, and the amalgam was sufficiently stripped, then zinc from $FeZn_7$ crystals began to dissolve.

A cell with inclined 1 ft^2 electrodes was used in the first experiments. Cathodes were aluminium, and anode plates were galvanized iron sheets. Refining electrolyte was a chloride type developed by the authors while working on a related project. Composition of this solution is given in Table II.

Final testing was accomplished in a cell, using vertical electrodes. The primary advantages of the vertical electrode cell over an inclined electrode

Fig. 3—Diagram showing arrangement of dross refining system



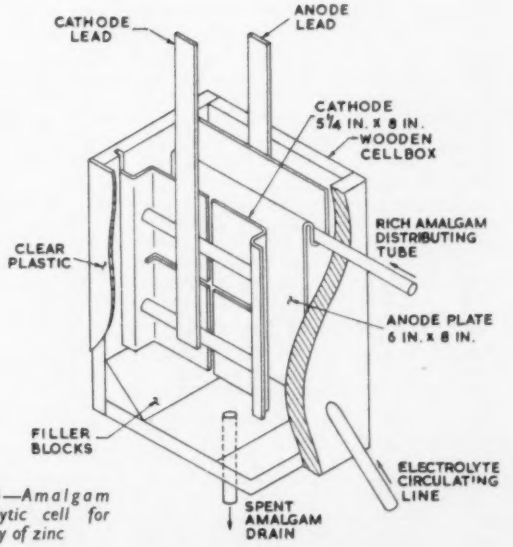


Fig. 4—Amalgam electrolytic cell for recovery of zinc

TABLE III—AMALGAM REFINING OF GALVANIZER'S DROSS, USING INCLINED ELECTRODE CELL

Run No.	Duration of run hr.	Current density, amp/ft²	Current consumed amp/hr.	Cell voltage	Average deposit thickness in.	Weight of deposit, gm.	Current efficiency, per cent	Zinc* purity, per cent	Power efficiency† lb/kWh.
1	28	10–40	1073	0·28–0·5	0·074	1,291	98·6	99+	5·3
2	21	20–40	776	0·28–0·5	0·053	933	98+	‡90+	5+
3	50	20–40	2107	0·28–0·5	0·154	2,404	93·5	99·9+	5·0
4	28	20–40	1127	0·28–0·5	0·106	1,365	99·3	99+	5·3
5	22·8	20–40	877	0·38–0·46	0·065	1,036	95+	§90+	5+
6	28	20–40	1113	0·38–0·46	0·084	1,300	95·6	99·99+	5·6
7	21·9	20–40	837	0·28–0·44	0·064	1,020	99·9	99+	6·1
8	28	20–40	1095	0·32–0·53	0·097	1,310	98·1	99·99+	5·0
9	31·6	20–40	1164	0·27–0·5	0·085	1,390	97·9	99·99+	5·3
10	28·4	20–40	1043	0·28–0·61	0·092	1,310	100	99·9+	4·6
11	30·6	20–40	1173	0·28–0·76	0·097	1,380	96·4	99+	3·4

**Includes mercury present in deposits*
†At 40 amp/ft²
‡Amalgam completely stripped. Deposit contained cadmium and lead
§Deposit shorted to anode and absorbed mercury

cell were as follows: (1) less attention was required during operation; (2) longer runs were possible, producing thicker cathode deposits; (3) less mercury was required in the cell; (4) a continuous amalgam film was maintained on the anode face without difficulty.

Results that were obtained using both inclined and vertical electrodes are given in Tables III and IV, both of which show that the amalgam refining method consistently produced thick deposits of pure zinc at high current efficiency. Deposits that showed the greatest quantities of impurity became contaminated with mercury either by splashing or by accidental contact between electrodes when the cathode was removed for examination.

High current efficiency and low cell voltage resulted in a yield of 5 to 6 lb. of zinc per kWh of direct current power consumed. This yield is considerably greater than the maximum theoretical yield of 3·5 lb/kWh in recovering a lower grade zinc from dross by the modern practice of distillation at atmospheric pressure.

The purity of the zinc product indicates how well the principles of amalgam electrolysis apply to this system. Lead, which is of vital concern in products from commercial electrolytic zinc plants, was normally present in these deposits in quantities less than 0·001 per cent, even though lead was one of the main impurities in the dross and eventually became the chief impurity in the amalgam. Iron, cadmium and other impurities present in the dross were also prevented from reaching the refining electrolyte by the blocking action of the amalgam, the same as lead.

A special series of runs (5 through 15 in Table IV) was made to study operations through a complete cycle. An accurate accounting was made of all materials charged, starting with new electrolyte and stripped amalgam. The series ended after restripping the amalgam to less than 0·05 per cent zinc. A material balance for the series follows:

	Quantity
Material :	
Dross charged, gm.	9,199
Zinc in dross (95·5 per cent zinc), gm.	8,785
Deposits recovered, gm. ..	8,592
Zinc recovery, per cent ..	97·8

Near the end of the series the leaching column contained only a few pieces of dross and a thick layer of floating sludge. Leaching rates became slower than the stripping rate; as a result, it was necessary to reduce current density and to avoid stripping the amalgam to such a low concentration of zinc that lead, cadmium and other impurities could begin fouling the electrolyte. Apparently, zinc in the iron-zinc compound ($FeZn_7$) was not as readily dissolved in the amalgam as the free zinc

TABLE IV—AMALGAM REFINING OF GALVANIZER'S DROSS, USING VERTICAL ELECTRODE CELL

Run No.	Dross charged, gm.	Duration of run hr.	Current density, amp/ft²	Current consumed, amp/hr.	Cell voltage	Average deposit thickness, in.	Weight of deposit, gm.	Current efficiency, per cent	Zinc* purity, per cent	Power efficiency,† lb/kWh.
1‡	—	34·7	20–40	454	0·2 –0·42	0·133	585	—	—	—
2‡	—	21·15	25–40	274	0·2 –0·4	0·101	478	—	—	—
3‡	—	27·03	20–40	347	0·25–0·45	0·102	535	—	—	—
4‡	—	65·5	20–40	903	0·25–0·48	0·211	1070	97·2	99·9+	5·4
5‡	1757	12·10	20–40	152·80	0·23–0·48	—	186	—	—	—
6‡	§	12·93	20	100·21	0·23–0·28	—	122	—	—	—
7	§	27·55	20–40	385·08	0·2 –0·5	0·10	463	98·6	99·98+	5·3
8	§	31·30	20–40	412·14	0·29–0·47	0·09	515	102·4	99·99+	5·7
9	1537	62·10	20–40	913·71	0·25–0·48	0·20	1121	100·6	99·99+	5·6
10	1611	64·50	20–40	940·20	0·29–0·54	0·24	1119	97·6	99·99+	4·9
11‖	1261	48·00	20–40	628·11	—	0·16	759	98·8	99·97+	—
12	1513	56·33	20–40	808·29	0·31–0·54	0·20	959	97·3	99·96+	4·9
13	1520	48·42	20–40	671·97	0·25–0·55	0·16	808	98·6	99·7+	4·8
14	§	126·65	20	1018·65	0·25–0·38	0·23	1217	97·9	99·0+	7·0
15	§	124·97	25	1089·21	0·34–0·53	0·27	1324	99·6	99·98+	5·1

**Includes mercury present in deposits*
†At 40 amp/ft²
‡Preliminary runs with saturated amalgam. Current not recorded. Deposits not analyzed. Thin deposits; thickness, efficiency, purity insignificant
§None
‖Defective voltmeter

in the dross. This problem would probably be less serious in a larger system, when additional leaching facilities would be available and a counter-current leach could be carried out.

Sludge skimmed from the column contained zinc, iron and other impurities wet with mercury. Most of the mercury was recovered by pressing at 5,000 lb/in^2. The cake from pressing yielded the remaining mercury easily upon distillation under vacuum. During these tests there were no measurable losses of mercury other than several ounces discarded on obsolete anode plates.

The chloride electrolyte performed exceptionally well during these tests and was superior to any sulphate formulas tested. There was no noticeable gassing at the cathode. Treeing problems were eliminated, and the only cathode surface irregularities were smooth nodules. Because of the presence of chloride ion, electrolyte conductivity was good and cell voltage of 0·5 compared favourably with 0·7 for strong acid-sulphate cells. The stability of the chloride electrolyte is shown by its performance in the series of runs 5 through 15 (Table IV). The entire series represented 615 hr. of operation, during which time the original glue and aerosol content of the solution was replaced only once. Additions of water were required to make up for evaporation losses, and small additions of fresh electrolyte were made to compensate for drag-out losses. Zinc content of the solution changed slightly from 3·58 per cent at the start to 3·84 per cent at the end. Additional proof of the exceptional stability of the electrolyte is shown by its length of service. During 615 hr. of operation, 1·7 lb. of zinc were produced per lb. of electrolyte. This solution was still performing satisfactorily at the conclusion of the series of runs, and apparently would have remained useful indefinitely provided addition agents were replenished as they became depleted.

Early experiments with this electrolyte disclosed several objectionable features. Zinc, plated at 40 amp/ft^2, was deposited with severe compressive stresses that soon led to buckling of the deposit. The most effective correction for this problem was to section the cathode into 4 in. squares and start electrolysis at lower current densities. Deposits that started at 20 amp/ft^2 and built up for about 6 hr. had sufficient thickness and strength to resist buckling tendencies later at the higher current density. Newly-prepared electrolytes were more prone to cause buckling than those having served through one run.

References

1 H. Hohn; Amalgammetallurgie, *Österr. Chem.-Ztg.*, 1948, **49**, 11, 15, 60, 102.
2 *Research*, 1950, **3**, 407.
3 *Research*, 1950, **3**, 16.
4 E. Kuss; *Z. Angew. Chem.*, 1950, **62**, 519.
5 R. B. MacMullin; *Chem. Eng. Prog.*, 1950, **46**, 440.
6 E. Cohen and K. Inouge; *Z. Physik. Chem.*, 1910, **71**, 625.
7 W. J. van Hertern; *Z. Anorg. u allgem. Chem.*, 1904, **42**, 129.
8 N. A. Puschin; *Z. Anorg. u allgem. Chem.*, 1903, **36**, 201.
9 H. E. Thompson, Jnr.; *J. Phys. Chem.*, 1935, **39**, 655.

(To be concluded)

MEN and Metals

It has been announced by the Federation of British Industries that **Dr. D. H. Sharp,** Ph.D., F.R.I.C., has been appointed director (technical) of the Federation in succession to **Major-General A. J. H. Dove,** who retires at the end of next month.

Pro-Vice-Chancellor of the University of Durham and Warden of Durham Colleges, **Dr. D. G. Christopherson,** O.B.E., F.R.S., will give the first annual lecture of the British Conference on Automation and Computation in London on Wednesday next. He will speak on the subject "Mathematics—Friend or Foe?"

Resigning his position with Tube Investments Limited, **Dr. C. Edeleanu,** M.A., Ph.D., is next month taking charge of the Materials Group at I.C.I. at Billingham.

A new appointment has been announced by B.B. Chemical Company Limited, of Leicester. **Mr. L. E. Puddefoot,** B.Sc., is to be the company's first director of supply and among his new functions will be the responsibility for the purchasing activities of the company.

In place of **Lieut.-Col. S. G. C. MacWatters,** who has retired, **Mr. G. S. W. Marshall** has been appointed a director of Capper Pass and Sons Limited.

Engineering appointments in the turbine-generator division of Associated Electrical Industries Limited have been announced as follows:—**Mr. J. S. Hall,** B.Sc., A.M.I.Mech.E., divisional assistant chief mechanical engineer (turbines); **Mr. J. V. Bigg,** M.A., A.M.I.Mech.E., A.M.I.Mar.E., divisional assistant chief mechanical engineer (auxiliary apparatus) and chief engineer, general engineering department; **Mr. D. M. Smith,** F.R.S., M.I.Mech.E., F.R.Ae.S., consulting mechanical engineer; **Dr. D. F. Shannon,** Ph.D., M.I.Mech.E., chief engineer, mechanical experimental development and gearing; **Mr. F. R. Harris,** B.Sc., A.M.I.Mech.E., chief engineer, advance turbine development, and chief engineer, gas turbine engineering department; **Mr. J. C. London,** B.Sc., M.I.Mech.E., A.M.I.C.E., chief engineer, large steam turbines; and **Mr. A. A. Garson,** M.A., A.M.I.Mech.E., chief engineer, medium steam turbines.

Standard Specification

Schedule of Copper Alloy Ingots and Copper and Copper Alloy Castings. (*B.S.*1400.) *Price* 20*s.*

GENERAL, chemical and mechanical requirements for high-conductivity copper castings and for castings and ingots in 33 copper alloys are brought together in this publication.

Among the many changes in the new publication, a most useful addition is the inclusion of a colour code for each of the ingots specified.

High conductivity coppers HCC1 and HCC2 and new alloys PB4, LB4, LB5, G3, SCB4, SCB5, CMA1, CMA2, and DCB3 have now been included. Three of these arise from an extension of the range of brasses previously designated "B", and its sub-division into sand-cast brasses (designated "SCB") and die-cast brasses (designated "DCB").

A number of amendments have been made to the chemical compositions of the alloys, including differentiation between the limits specified for ingots and castings for certain of the elements.

Mechanical properties have also been reviewed and a number of amendments made. Throughout, reference is made to "permanent set stress" instead of "proof stress", as the former is the test used with copper-base casting alloys and is now defined in B.S.18, "Tensile Testing of Metals".

For the phosphor bronzes, leaded bronzes and gunmetals, properties for continuously cast material have been included.

For the gunmetals and leaded gunmetals, recent research on the effect of impurities has been taken into account in fixing limits only for those elements known to be harmful and likely to be present, and a total figure has not been included.

Copies of the above-mentioned standard may be obtained from the British Standards Institution, 2 Park Street, London, W.1.

OUT OF THE MELTING POT

Spot "Welding" SPOT welding, while in most cases still remaining the essentially simple process it has always been, has not succeeded in avoiding the fate of all developments, that of suffering further developments by additions and elaborations. While the spate of suggestions for methods of pretreating the surfaces to be welded (in particular of aluminium) with a view to removing surface films and/or producing a reproducible and stable surface state or film has died down, leaving spot welding much as it had been, one or two recent suggestions relate more particularly to the process itself. Thus, for example, there has been the suggestion for improving the process of spot welding aluminium by supplying to the surfaces to be welded, prior to or during the welding operation, an organic nitrogen compound of a higher alcohol. In addition to facilitating the welding process, the presence of the compound is claimed to reduce contamination of the electrode tips. An even more radical change in the spot welding process is envisaged in a suggestion for the spot welding of certain awkward combinations, such as, for example, copper and stainless steel. Such welds are facilitated by placing a paste-like mixture of powdered hard solder (melting point between 580° and 860°C.) and finely divided high melting point additives (e.g. a mixture of copper, nickel, manganese and silicon), which have melting points above that of the hard solder and which are capable of alloying with the metal surfaces to be joined, between the two surfaces and then passing a welding current between the surfaces. This results in the melting of the hard solder which wets the surfaces before the welding temperature is reached and welding of the surfaces takes place. By covering the surfaces, the molten hard solder prevents any oxidation of the surfaces. Oxidation can be further prevented by including one or more reducing agents, such as zinc chloride, in the hard solder mixture. Alternatively, the process can be carried out in an atmosphere of an inert gas.

Inconspicuous PROGRESS in any scientific and technical field chosen at random was never, it would be generally agreed, more rapid than at present. All the efforts put into scientific research and all the endeavours to put anything practicable into practice as soon as possible must inevitably accelerate progress more and more. While all this is quite readily accepted without any particular evidence being demanded, it is always felt to contrast strangely with the paucity of evidence that is discovered whenever an actual attempt is made to survey recent progress in any particular field, such as metallurgy, or some section of metallurgy as for example, metal working, or the applications of the less common metals, or soldering. What are the causes of this unexpected situation? One of them may reside in the reviewer. In him, familiarity with recent developments and a knowledge of their development following their first appearance on the scene tend to breed contempt. The difficulty is, however, not only a subjective one. As progress continues, advances and developments are being made at higher and higher levels or in smaller and smaller details. Such advances and developments may be quite important in themselves, but by their very nature, development of some *n*th degree, an appreciation of which requires a gradual approach through the lower stages of development, are bound to be more difficult to discover. Then there is the difficulty arising from the disproportion between the numbers of existing developments and of those made more recently. It was much easier to spot and appreciate developments where there were few or none already in existence, but it is much more difficult to perceive new growths among and through the existing accumulations. To conclude: the difficulty of surveying new developments and the conspicuous lack of such surveys cannot be taken as evidence that somehow or other and somewhere or other developments do not continue to appear.

Gold Resistance FEW other alloys have to combine so many, partly mutually exclusive, properties as the high electrical resistance alloys required in the form of wire for potentiometers and the like. In addition to a high electrical resistance (which permits a reduction in size of the potentiometer) they must have a low temperature coefficient of resistance, adequate ductility to permit wire drawing and winding, and also a high resistance to wear, a constant low contact resistance, an electrical resistance which remains constant over long periods of service and, finally, a good corrosion resistance. Some of these requirements can be met by alloys based on precious metals. Thus, palladium-silver, gold-silver-copper, platinum-copper-nickel and palladium-tungsten have proved suitable in a number of cases, but if the base metal alloying additions are kept low enough to ensure satisfactory ductility for working, the specific resistance of such alloys is relatively low. Somewhat higher values can be obtained by heat-treatment with gold-iron alloys with iron contents in excess of 27 per cent but the heat-treated alloys are not quite satisfactory in regard to the stability of the resistance and resistance to corrosion. An unexpectedly favourable combination of the relevant properties is, it has now been discovered, obtainable in compositions within the range of 85 to 40 per cent gold, 10 to 55 per cent palladium, 1 to 5 per cent titanium and 3 to 8 per cent iron. Undoubtedly the most remarkable feature of these alloys is that, contrary to the usual behaviour of resistance alloys, they exhibit their best possible resistance in the soft-annealed conditions. This means that their resistance remains constant over long periods of service, even should the potentiometers become overheated as a result of a circuit fault. As the temperature coefficient of resistance of these alloys is also very low, potentiometers using these alloys can be loaded much higher than potentiometers using the alloys known hitherto.

Skimmer

New Plant and Equipment

Oil Recovery

A COMPACT machine for separating cutting oil from machined swarf or processing and tempering oils from components has been introduced by R. Cruickshank Ltd., Camden Street, Birmingham. The oil is saved for immediate re-use.

In this machine, the 3C oil separating centrifuge, the swarf or components are inserted into a perforated metal basket, which is then placed on to the drive-dog in the base of the centrifuge. As soon as the spring-loaded lid is closed, the basket rotates at 420 r.p.m.

Centrifugal force displaces the surplus oil while the heating element follows up with hot air to reduce the viscosity of the remaining oil on the swarf or components. The hot air is blown into the basket by an impeller. This double action of removing all the oil possible, ensures that the greatest amount of oil is reclaimed. It only takes 2-3 min. to separate, filter and pass the oil into a container ready for immediate re-use.

Three safety measures are incorporated in the machine: it cannot be operated unless the lid is closed; a plunger button overrules any other action; and an electric magnetic brake stops the revolving action as soon as the lid is lifted—even at $\frac{1}{8}$ in.

In pre-production trials, aluminium swarf, scheduled to be melted down for re-use, yielded 2-3 gal/hr. of oil and, in addition, the removal of the oil eliminated the nuisance of dense smoke when melting the swarf down.

Experience has already proved that the machine is equally suitable for removing tempering oil from components. One pre-production trial with small, oil tempered springs, resulted not only in the oil being reclaimed but, subsequently, 50 gal/week of trichloroethylene degreaser was saved.

Dust Control

RECENTLY added to the range of unit dust collectors manufactured by Dallow Lambert Limited, of Thurmaston, Leicester, the Uma Unimaster has an entirely new design of one-piece filter pad assembly which allows for easy removal. This new design also makes the replacement of filter elements a much cheaper matter. Greater spacing between filter pads allows for the handling of more difficult dusts. A new design of filter inserts in conjunction with a simplified shaker linkage and a new patent shaker bar result in greatly improved cleaning of the filter element. Additional improvements incorporated are as follows: (a) improved fan performances; (b) re-designed dust seals to withstand greater pressure differentials; (c) greater rigidity of unit case and base; (d) easier manual release of filter pad seal frame; (e) extended range of filter fabrics, both natural and synthetic.

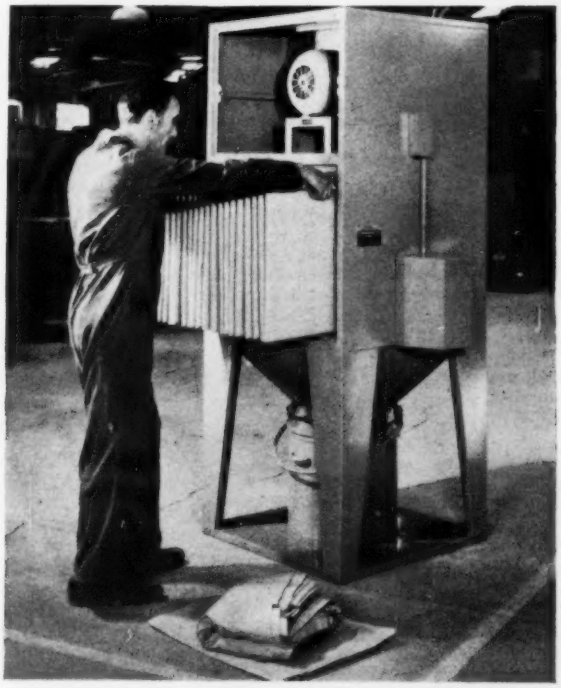
Feeding Processes

FOR feeding controlled amounts of dry materials into processing operations of many kinds, the Vibra screw volumetric feeder uses vibratory action to avoid sticking, bridging or flooding. It is especially suitable for feeding reagents into metallurgical flotation processes. This machine, a product of Simon Handling Engineers Ltd. and Henry Simon Ltd., Cheadle Heath, Stockport, Cheshire, incorporates a screw mounted on a vibrator in such a way that the screw, screw trough, screw bearings and discharge tube vibrate as one assembly while the screw rotates.

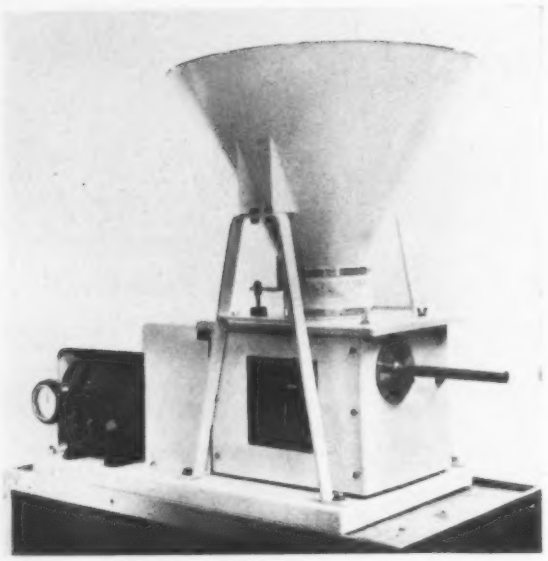
Feed rates are proportional to the speed of rotation of the screw and are infinitely variable over a range of approximately 50:1. A constant level of material is maintained over the screw to eliminate feed rate fluctuations. With most materials, deviations are kept to within ±1 to 2 per cent minute to minute.

The standard range of Vibra screw feeders consists of ten graduated sizes having screws ranging from $\frac{1}{4}$ in. to

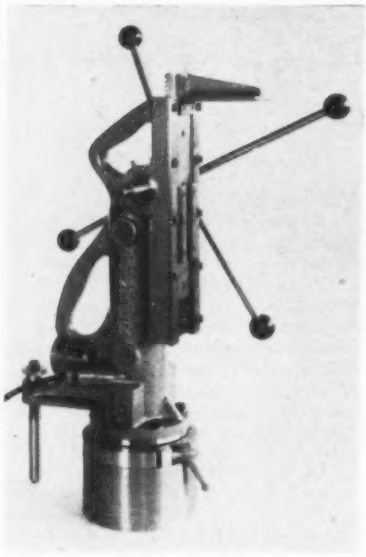
Left: The Cruickshank 3C oil separating centrifuge



Right: Dallow Lambert Uma Unimaster dust control unit showing removal of filter



Left: The Vibra screw feeder for transferring controlled amounts of dry materials to machines or processes



Right: Jäger portable magnetic drill press

4 in. diameter and providing feed rates ranging from a few ounces to tons per hour.

The controlled vibration to which the material is subjected also contributes to the exceptional accuracy of the Vibra screw feeder by eliminating aeration and ensuring constant density of the material before it flows into and through the screw and discharge tube.

The Vibra screw feeder handles fine powders, flakes and pellets without degradation taking place and delicate crystalline materials can also be handled without breaking down.

The standard machine construction is mild steel with the screw and discharge tube of stainless steel, but aluminium and plastics finishes can also be supplied to meet specific chemical and other requirements.

Temperature Measurement

THERMOCOUPLES for detecting temperatures in industry and research of up to 4,200°F. are to be marketed by Honeywell Controls Limited, Greenford, Middlesex.

Materials used are combinations of tungsten, rhenium, rhodium, molybdenum, iridium and platinum. Certain of these thermocouples have maximum temperature ratings of 3,000°F., others of 3,200°F., 3,600°F., 4,000°F. and 4,200°F.

Types are available for both oxidizing and reducing environments.

The maximum of 4,200°F. is obtained by using tungsten versus tungsten-26 per cent rhenium. The thermoelectric output of such a thermocouple is nearly three times as great as that of the tungsten-rhenium thermocouple, which it will largely supersede. The temperature e.m.f. curve is more linear in the 2,000°-4,000°F. range. Improved uniformity of wire is obtained owing to the 26 per cent alloy being more homogeneous. Error is claimed to be less.

Another of the new thermocouples uses platinum-30 per cent rhodium versus platinum-6 per cent rhodium, and is for continuous use up to 2,732°F. and intermittent service up to 3,272°F.

Radial Drilling

NOW available in Great Britain through the agency of I.F.M. (Developments) Ltd., Midland Bank Chambers, Lye, Stourbridge, the Jäger portable magnetic drill press offers versatile, portable radial drilling facilities where only hand drills are available. It can be secured very firmly to an iron piece of work, stanchion or plate by means of an electromagnet. This magnet is housed in a large round base mounted under the stand. By a turn of a locking handle the drill can be swivelled around the lower magnet base and moved laterally, assuring absolute precision-positioning for drilling, reaming and tapping. At the side of the stand are guides, along which the drill can be moved parallel to the axis of the stand by means of a rack and pinion with capstan.

Any type of pneumatic or electric hand drill can be fastened by means of the accessories. This magnetic drill press aids accurate drilling, or tapping and reaming in any position (horizontal, vertical, or even in overhead position). The magnetic drill press converts the hand drill, so to speak, into a fixed drilling machine on a piece of work. This has the advantage that work can now be carried out on the spot, thereby avoiding high transportation costs for heavy and extensive pieces of work.

It has a drilling capacity up to 32 mm. (1¼ in.), 50 mm. (2 in.) with low feed; a maximum magnetic pull of 1,200 kg. (2,644 lb.). The drill point pressure is 850 kg. (1,850 lb.) and it has a turning radius of 350°, and a lateral movement of 20 mm. (¾ in.). The drill press operates on A.C. single phase 42-110-220 V, 100 W. It has a length of stroke of 300 mm. (11·8 in.).

Melting Aluminium Bronze and Hardener Alloys

—*Continued from page 225*

necessary to ensure satisfactory performance in service of the finished aluminium bronze components.

The physical laboratory houses the mechanical testing equipment, viz: a 15T Dennison tensile machine; hardness testers by Vickers, Brinell (2) and Rockwell; a Solus-Schall ultrasonic crack detector; and an Ardrox die penetrant set.

Chemical and physical tests are carried out on all casts where required.

Billets for forgings, extrusions and wrought applications are generally accepted on analysis without the physical tests except where requested as an additional requirement.

Forgings and rings produced are accompanied by the results obtained from a test-piece cut from a process piece and subjected to A.I.D. or other requested test procedure. All wrought products are subjected to ultrasonic examination.

Visual examination of samples cut from billets is carried out to assess grain size and internal soundness.

The Ashton quality control is, therefore, strictly applied over a wide field of products to requirements including A.I.D., B.S.S., A.S.T.M., oil company and similar standards.

Industrial News — Home and Overseas

Metal Recovery

Patents have been applied for a new metal recovery machine which is being introduced by the **Wilfley Mining Machinery Company Ltd.,** and which, they claim, is a cheap and efficient means of recovering metal from non-ferrous foundry residues.

Thanks to the co-operation of **Advance Foundry Company,** trials on a prototype have been carried out under working conditions. On a dump of brass skimmings an input of 4½ cwt. per hour was achieved and a good clean metal concentrate was produced. This "Wilfley" reclaimer is now going into production and will be available shortly.

Factory Construction

A new £250,000 development plan for their Sheffield factory has been announced by **Stanley Works (G.B.) Ltd.** The major part of the plan is the erection of a modern 33,000 ft² administration block on a site adjoining the factory. This will release valuable production space at present being occupied by offices in the factory building

In addition, a new floor is being added to one wing of the factory and a new line of finishing shops, now nearing completion, have been added, providing a total of 20,000 ft². Work on the new administration building is expected to begin towards the end of this year and to be completed about the end of 1962.

Order from Russia

Following an enquiry received at the British Trade Fair in Moscow this year, an order for industrial *p*H measuring, recording and controlling equipment worth £15,000 has been obtained by **W. G. Pye and Company Ltd.** from the official U.S.S.R. buying agency, Mashpriborintorg.

Sales Appointments

Three new appointments, increasing the number of their outside sales representatives to 14, have been made by **Aerostyle Limited** as follows: Mr. F. T. Houlan, who joined the firm in 1937, will cover East London, Essex and the East Coast; Mr. A. G. Synnuck has been with the firm for nearly 11 years and will be responsible for London, E.C., North Middlesex, Bedfordshire and Hertfordshire; and Mr. J. Fulton, who joined the company six months ago, will cover N.W. London, West Middlesex, Buckinghamshire and Oxfordshire.

The Cromcote Series

Two new additions to their existing Cromcote series have been announced by the **Walterisation Company Ltd.** The first, to be known as "Cromcote B.R." is a chromate conversion treatment for brass and other cuprous alloy surfaces. The treatment will have considerable value in preventing tarnishing of the surface and rendering it resistant to finger marking and other similar damage.

Two processes for zinc and galvanized steel surfaces have been developed and will be designated "Cromcote Z.C. and Z.H." The Z.C. process would normally be offered as a corrosion protection and paint-bonding treatment. The Z.H. process is a special development of the Z.C. designed for the treatment of newly galvanized work. The process comprises a make-up and a replenishment concentrate.

Aluminium Outlook

Addressing the American Mining Congress at Seattle last week, Mr. Walter L. Rice, President of Reynolds Mining Corporation, said that the aluminium industry, despite its current idle capacity of 500,000 tons, could enter a boom period "sooner than anyone has the temerity to predict". He said that although aluminium shipments in the first half of this year were four per cent below the same period last year, they have rebounded sharply, and are now probably at an annual rate exceeding 2½ million tons. This acceleration should bring shipments for the full year 1961 to 2,450,000 tons, four per cent over 1960, Mr. Rice said. The all-time record year was 1959, when 2,480,000 tons were shipped.

"In the three big advances of the economy in the past ten years—in 1953, 1955 and 1959 — aluminium shipments zoomed up 25 per cent or more", Mr. Rice added. "With the economy moving forward at a rapid rate, goaded by the Administration's stepped-up spending for housing and other domestic programmes, and with the new armaments programme due to add billions more in payrolls, who is to say it cannot happen again?"

Scottish Branch for Canning

A new branch of **W. Canning and Company Ltd.** has recently been opened at 33 Square Street, Whiteinch, Glasgow, where stocks of a wide range of electroplating chemicals and metals, polishing materials, brushes and lacquers, will be carried.

Mr. K. J. Chambers, the resident representative of the company, is now area superintendent for Scotland, and the warehouse is managed by Mr. S. V. White, who has been transferred from the company's Sheffield branch. A well-equipped laboratory is in operation and technical service is available through Mr. D. Hudson.

Tin Council Statistics

Production of tin-in-concentrates in the Federation of Malaya rose to 5,170 tons in July from 4,807 tons in June, the International Tin Council stated last week. Thailand output declined to 1,061 tons in July from 1,145 tons in June, while Bolivia's production fell to 1,224 tons in June from 1,786 in May. Exports of tin-in-concentrates from Thailand rose to 1,454 tons in June from 1,153 in May.

Imports of tin-in-concentrates into Malaya and Singapore in July totalled 1,420 tons, as against 1,662 tons (revised) in June, while imports to the United Kingdom declined to 1,746 tons in July from 2,014 tons in the month previous. A total of 391 tons were imported into the United States in June compared with 223 tons during May.

Stocks of tin-in-concentrates in Malaya and Singapore declined to 4,173 tons at the end of June from 4,588 tons end-May. Stocks in Bolivia were also lower at end-June, totalling 1,086 tons compared with 1,664 tons a month earlier. Stocks at smelters in the United Kingdom fell to 1,162 tons at end-July from 1,416 tons at end-June. Smelter production of tin metal in the United Kingdom in July fell to 2,062 tons from 2,494 tons in June, while output of tin metal in Australia during May and June amounted to 276 and 275 tons respectively.

Exports of tin metal from Malaya and Singapore rose to 6,622 tons in August from 6,419 tons in July, according to provisional figures. Exports from the United Kingdom were again relatively high during July, when they amounted to 1,661 tons against 2,171 in June.

Imports of tin metal into the U.S.A. showed little change in June, totalling 3,020 tons as against 3,046 in May. Imports of tin metal into France rose to 1,403 tons in June from 1,008 tons in May, while in July they fell to 935 tons. A total of 255 tons were imported into the United Kingdom in July compared with 80 tons in June. Stocks of tin metal with consumers in the U.S.A. declined slightly to 16,370 tons at the end of June against 16,700 tons at end-May, while stocks at official warehouses in the United Kingdom fell to 5,701 tons at end-August from 6,194 tons at end-July.

Consumption of primary tin metal in Federal Germany during the second quarter of 1961 is reported at 11,058 tons, compared with 8,992 tons during the first quarter, while consumption in the U.S.A. during June amounted to 4,420 tons, compared with 4,380 tons during May.

Welding News

Early notice is given of the Autumn Meeting of the **Institute of Welding,** which is to be held in London from October 30 to November 3 next. The meeting will include the Presidential Address, the annual dinner, and a Symposium on "Welding in Shipbuilding".

For the Small Exhibitor

A new booklet called "Trade Fairs Help Exports — Hints for the Small Exhibitor" has been produced by the Board of Trade for the guidance of small firms contemplating exhibiting overseas for the first time.

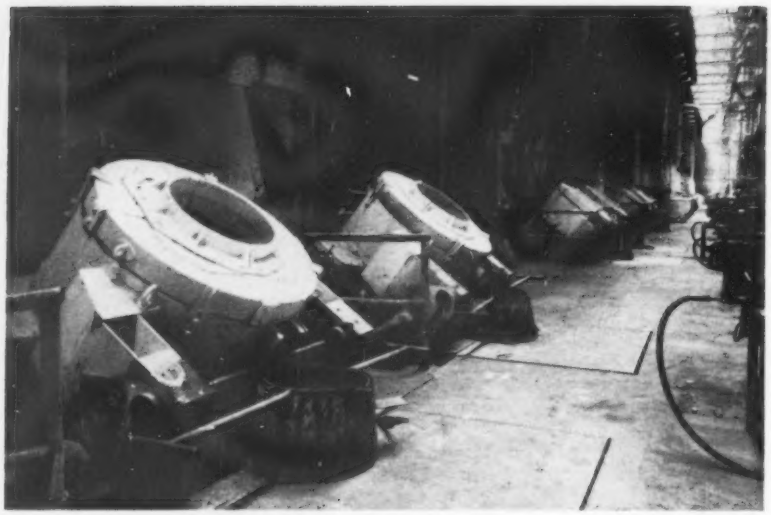
The booklet explains the purposes of exhibiting and gives guidance on the choice of fairs, the organization of exhibits and on official assistance available to the British exhibitor. It also lists major specialized fairs overseas. Copies can be obtained free of charge from any Board of Trade Regional Office or from Export Publicity and Fairs Branch, Board of Trade, Horse Guards Avenue, London, S.W.1.

Forthcoming Event

On Thursday next (September 28), the **Non-Ferrous Club** is holding a dinner for members and male guests at the Greswolde Hotel, Knowle, Warwickshire. The proceedings are timed to commence at 7.15 p.m.

For Gravity Die-casting

Eight "Morgan" basin tilting furnaces of 50 lb. (225 kg.) aluminium capacity at



Basin tilting furnaces supplied by Morganite Crucibles Ltd., to Aeroplane and Motor Aluminium Castings Ltd.

the Birmingham works of **Aeroplane and Motor Aluminium Castings Ltd.** are said to comprise the largest battery of this make and size of furnace in the U.K.

Our photograph on this page shows six of the furnaces supplied by **Morganite Crucible Limited,** which are now being used for the melting and treatment of an aluminium alloy for the production of the first gravity die-cast overhead valve aluminium cylinder heads. At present these cylinder heads — formerly always sand-cast—are being supplied for cars produced by the Rootes Group, Daimler Cars Limited, and other leading motor manufacturers.

U.K. Metal Stocks

Stocks of refined tin in London Metal Exchange official warehouses at the end of last week fell by 10 tons, to 5,516 tons, comprising London 2,376, Liverpool 1,739 and Hull 1,401 tons.

Copper stocks rose by 200 tons to 22,084 tons, distributed as follows: London 450, Liverpool 17,584, Birmingham 50, Manchester 3,925, Hull 50 and Glasgow 25 tons.

Lead duty-free stocks fell by 25 tons, to 7,031 tons, comprising London 6,781, Glasgow 100 and Swansea 150 tons, while in-bond stocks fell by 175 tons, to 3,652 tons, all in London.

Zinc duty-free stocks fell by 100 tons, to 3,690 tons, comprising London 2,571, Glasgow 66, Hull 570, Manchester 400 and Liverpool 83 tons, while in-bond stocks fell by 71 tons, to 3,213 tons, all in London.

Tube Plant for Export

News from the **Head Wrightson Machine Company Limited,** a subsidiary of Head Wrightson and Company Ltd., is that the company has received an order from the Finnish metalliferous mining and copper producing company Outokumpu Oy. of Pori, for the supply of a large tube drawbench to be used in the manufacture of non-ferrous tubes, valued at approximately £100,000.

The bench is to be of the single chain triple draw type, having a maximum pull of 100,000 lb. and capable of drawing tubes up to 150 ft. in length, and provided with special electrical equipment to give infinitely variable speeds of draw up to a maximum of 300 ft/min.

This drawbench is arranged for semi-automatic operation and will incorporate a number of special features which have been developed over recent years to enable high rates of production to be achieved with one-man operation. A number of similar drawbenches have recently been supplied or are at present being manufactured for copper tube plants in this country, Australia and Italy.

New Phosphating Process

Developed and introduced by the **Paints Division of I.C.I.,** "Kephos" (patents pending) is a non-aqueous phosphating process which, it is stated, dispenses with rinsing and tank-heating, forms no sludge in the processing tank, and produces a sealed phosphate coating. The phosphate coating enhances paint adhesion and resistance to rust creep in the same way as conventionally produced zinc or iron phosphate coatings. The improvement in the corrosion resistance of paint systems is quite outstanding and the possibility of work being contaminated by water-borne impurities is eliminated.

"Kephos" contains a sealer which is sufficiently corrosion-resistant to protect work during transport or temporary exterior storage for up to a week, or indoor storage up to six months. Under normal production conditions, work can be welded through the "Kephos" film. This enables items to be treated before fabrication, so that shrouded areas such as interior box sections receive some protection.

"Kephos" is not confined to dipping. It may be applied by brush, roller, spray or flow-coating, the most suitable method depending entirely on the characteristics and number of the articles to be treated. This process can be used to supplement existing phosphating facilities when an article is too large for the plant or an abnormal volume of work requires processing.

Machine Tool Conference

Machine tool users, designers, and research workers from 14 countries will meet in Manchester on Monday next (September 25) for a five-day discussion of their problems. Nearly 400 delegates are expected to attend the conference, organized at the Manchester College of Technology by a committee chaired by Prof. F. Koenigsberger.

This is the second time a conference of this character has been held in Britain; the inaugural conference, last year, was held at Birmingham University, and it is intended to continue holding annual research and design conferences in Manchester and Birmingham alternately. As the principal centres of the machine tool industry in this country, Manchester and Birmingham are natural choices for a conference on this subject. Both the Manchester and Salford Colleges of Technology are doing machine tool research; and the newly-formed Machine Tool Industry Research Association has established itself in Manchester.

Copper for Soviet Bloc

Exports of copper from West Europe to East Europe fell last year from 56,000 tons to 40,000 tons, according to a report published by the Economic Commission for Europe, a United Nations organization. The report said the decline, which largely affected British shipments of copper wire, followed the trend of recent years as the Soviet Union has stepped up imports of raw copper direct from producing countries like Chile and Rhodesia.

East-west European trade in aluminium last year totalled some 10,000 tons in each direction. In 1959 there had been an appreciable East European export surplus. Exports of Russian tin declined in 1960, in line with its undertaking to the I.T.C., says the report.

Japan Curbs Imports

In a move to curb imports, the Japanese Government has announced increases in the amounts importers will have to deposit with the Bank of Japan on import shipments. Until now, importers have been required to deposit bonds with the bank for up to one per cent of the import value of the shipment. Effective as from Monday last, the proportion to be deposited will range from 0·1 per cent to 35 per cent.

Included in the list of products for which a 35 per cent deposit will have to be made are raw copper and copper-base alloys.

The official announcement followed a conference of four key Cabinet Ministers held to discuss the recent deterioration of the country's payments balance. It said the new scale for deposits was expected to reduce Japan's imports by about 20 million U.S. dollars a month.

Mr. Eisaku Sato, the Minister of Trade,

Obituary

Mr. C. V. Hill

WE regret to record the death of Mr. Charles Vaughan Hill, former joint managing director of Charles Hill and Co. Ltd. and Hills Precision Die-Castings Ltd. He was for a considerable time sales director of the company and later became joint managing director with his brother, Mr. Edward Hill. He retired from active participation in the business some three years ago.

told the Japanese press that the present measure, coupled with the powerful export promotion programme now being worked out by the Government, was expected to bring about an early improvement of the balance of payments position.

Swiss Aluminium Production

News from Zurich states that Swiss virgin aluminium production in the second quarter of this year amounted to 10,460 tons, against 9,970 tons in the first quarter and a quarterly average of 9,933 tons in 1960, according to figures issued by the Swiss Committee for the Investigation of Economic Trends.

Cabma Register

The ninth edition (1961-62) of the Cabma Register of British Industrial Products for Canada has just been published. This register has been produced annually since 1953 for the Canadian Association of British Manufacturers, whose object is to develop an ever-greater market for British goods in Canada and so stimulate the two-way flow of trade between the two countries.

The classified list of products consists of more than 3,000 British products available to the Canadian market, with their suppliers given under each heading. The French equivalents of these headings are set out in alphabetical order in a separate glossary. A directory of nearly 4,000 British firms gives details of their distribution arrangements in Canada. Proprietary names and trade marks are given in special sections which enable the Canadian buyer to identify products and their sources of supply. The six sections of the register are easily identified by the slotted index and tinted paper.

The register is published jointly by Kelly's Directories Ltd. and Iliffe Books Ltd. It covers 620 pages and the price is 15s. 0d. post free.

Change of Address

Notification has been received from **Norton Grinding Wheel Company Ltd.** to the effect that, as from October 2 next, the address of the Manchester office and warehouse will be: Wharf Road, Sale, Cheshire, with the telephone number of Sale 8285-7.

New Power Press

A new capacity 6-ton "Worcester" power press has recently been introduced by **Jones and Attwood Ltd.** The brief specification of this machine is as follows: overall dimensions—36 in. high by 21 in. wide by 32 in. front to back; open tool height—8 in.; throat—4½ in.; bed size—12 in. wide by 8½ in.; ram adjustment—1¼ in.; fixed strokes available—1¼ in., ¾ in. or ½ in.; speed at ram—50 strokes/min.

A dial feed has nine stations and can be jig bored to customers' requirements.

Aluminium in Architecture

In July of this year, **The British Aluminium Company Limited** launched a building service designed to aid the architect in the selection of aluminium products for building. This service has now been extended to cover the Midlands area, and on Tuesday last over 100 architects were invited to the Chamber of Commerce building in Birmingham for the inauguration of this service.

They were addressed by Mr. John Madin, a well-known Midland architect, who outlined the service and spoke especially of the value of the manual "Aluminium for Architects", which has been compiled by British Aluminium to assist the architect in determining what products are available and where they can be obtained.

A further feature of the service is the technical advice service which backs up the manual. This service, staffed by specialists, is under the direction of Mr. Neill Newsum, and architects will be able to obtain expert advice on their problems, either from the local office of British Aluminium or from its London headquarters.

Aluminium for Building

Showing at The Building and Allied Trades Exhibition at Olympia, London, in November, for the first time is the newly-formed Building Products Division of **James Booth Aluminium Ltd.** The stand will display the first examples of a wide range of products designed specifically for the building and constructional industries—all of which will be available ex stock from the company.

Among the new products is Booth Boxrib, an 8 in. pitch troughed aluminium sheet with 1 in. ribs, which is intended primarily as a wall cladding. The sheets, made of ALM alloy, are 41¼ in. wide and can be supplied in lengths of up to 24 ft. It is claimed that the stucco-embossed finish provides an attractive appearance and the light weight — approximately 52 lb/100 sq. ft. — permits easy handling and faster and simpler fixing. The thickness of the sheets is 0·032 in. (21 S.W.G.).

Other new corrugated and troughed building sheets to be shown for the first time include 3 in. corrugated sheet, ¾ in. deep, available in widths up to 39½ in., lengths up to 14 ft. and in thicknesses of 20, 22, 24 and 26 S.W.G.; Mansard sheet, which has a pitch of 6 in., a ¾ in. depth of corrugation and a 4 in. wide flat, available in lengths of up to 12 ft., widths of 38 or 32 in., and thicknesses of 20, 22 and 24 S.W.G.; and Industrial Trough Type A, which has a 5 in. pitch and a trough 1½ in. deep, 2¼ in. wide at base and ⅞ in. wide at the crest, which is available in maximum lengths of 12 ft., widths of 36¼ or 31¼ in. and thicknesses of 20 or 22 S.W.G. Flashings and fixing accessories for use with all four types will also be shown.

Also on the stand will be examples of the wide range of aluminium sections which James Booth are introducing either as standard ex stock or produced to special order. The sections, which can be supplied anodized, include profiles for windows, curtain walling, handrails, thresholds, copings, skirtings, roof-edge fascias, etc., and for use as structural members.

Forthcoming Meetings

September 27 — Society of Instrument Technology. South Wales Section. Welsh College of Advanced Technology, Cathays Park, Cardiff. "Analytical Instruments for Process Control." E. J. West. 6.45 p.m.

September 27 — British Conference on Automation and Computation. Lecture Theatre, Institution of Electrical Engineers, Savoy Place, London, W.C.2. "Mathematics — Friend or Foe?" Dr. D. G. Christopherson. 5.30 p.m.

September 28—Institute of Metals. Birmingham Local Section. College of Advanced Technology, Birmingham. "The Origins of Strength in Alloys." Professor R. W. K. Honeycombe. 6.30 p.m.

September 28 — Non-Ferrous Club. Greswolde Hotel, Knowle, Warwickshire. Dinner for members and male guests. 7.15 p.m.

September 28—North-East Metallurgical Society. Cleveland Scientific and Technical Institution, Corporation Road, Middlesbrough. "Properties and Engineering Uses of Electrodeposited Metals." J. W. Oswald. 7.30 p.m.

September 28 — Southampton Metallurgical Society. Southampton University. "Metallurgical Failures in Aircraft Components." D. A. Ryder, A.C.T., A.I.M.

September 29—Institute of Metal Finishing. Sheffield and North-East Branch. Grand Hotel, Sheffield. "Plating Shop Layout and Installation." C. R. Darby. 7 p.m.

September 29—Society of Instrument Technology. Scottish Section. Scottish Building Centre, Sauchiehall Street, Glasgow. "A Chemical Engineer Looks at Instruments for a Chemical Plant." J. G. Sloan. 7.15 p.m.

Miniature Argon Torch

Details of a new argon welding torch have been given out by **Interlas Limited.** This is a Tec water-cooled miniature torch, and it is said to have unlimited applications in confined, hard-to-reach areas, as small as 1½ in. in diameter.

Torch head height, including transparent Vycor nozzle, is only 1¼ in., and it uses a tungsten electrode 1½ in. long. It will accommodate tungsten diameters of 0·010 in., 0·020 in., 0·030 in., 0·040 in., 1/16 in., 3/32 in., and ⅛ in. inclusive. Although small in size, the Tec miniature is stated to be capable of welding up to 300 amp. continuous duty cycle. It weighs approximately 2·5 oz., and has an overall length of 6½ in.

Birmingham News

A moderate amount of business is being done in the metal trades in Birmingham and surrounding areas. One of the active spots is that of light engineering, where most firms are still well engaged and are taking regular deliveries of raw material. No improvement is noted in the motor trade and more workers have been made redundant recently. It would seem that orders for new machinery and for new factory building have passed the peak, no doubt due in part to the financial restrictions imposed earlier in this year. Component parts used in connection with house building, however, are still in good demand.

Latest returns show that there was a big fall in iron and steel output in August. Some of this was due to holidays. Even so, many of the iron and steel mills are still working below capacity. The consuming trades are buying smaller tonnages and, where stocks are available, are postponing the placing of new business. The drop in the demand for household goods, in which light iron castings play an important role, is reflected in a shortage of work in some of the foundries.

Roller Hearth Furnaces

An order has been secured by **AEI-Birlec Ltd.** for the supply of three roller

hearth furnaces to Stewarts and Lloyds Limited, which are probably the largest so far ordered in this country for the duty.

Two of the furnaces are rated at 2,080 kW, to operate at a maximum temperature of 1,000°C., and the other is rated at 1,200 kW for a maximum temperature of 750°C. Each furnace is capable of an output of eight tons of steel tube per hour at its appropriate operating temperature, the maximum diameter of tube being 6 in. and maximum length 50 ft. The furnaces are adaptable to blue/black annealing, bright annealing, normalizing and low-temperature treatment. Valued at over £200,000, the plant is of the latest Birlec design and is to be commissioned during 1962.

Aluminium Bright Trim

On the occasion of the recent conference on anodized aluminium, held in Nottingham, the **Aluminium Development Association** made available to those attending the conference a useful brochure dealing with aluminium bright trim. The brochure is intended primarily for manufacturers of finished products and accessories with trim items, and also for the information of installation contractors, distributors and agents, as well as the many users in the various fields.

The brochure summarizes the aluminium-base materials available and gives brief notes on fabrication, brightening and anodizing. Illustrations of some of the many applications of bright trim are included. Test methods for controlling quality, and the means whereby the high initial quality can be fully retained in service, are discussed. It can also be used as the basis of a specification covering materials specially designed for bright trim applications, and also provides practical information of value to anodizers, engineers and designers.

A list of member companies of the association is included from whom sheet and strip, bars, rods and sections, extruded round tubes and hollow sections, and forgings suitable for bright trim applications may be obtained.

Ionizing Radiation Hazards

Six Orders have just been published which have been made by the Minister of Labour under the Ionising Radiations (Sealed Sources) Regulations, 1961.

These Orders, which come into force on February 1, 1962, prescribe the particulars to be kept of maximum permissible radiation doses and of doses received by each worker designated as a "classified worker" under the Regulations, of medical examinations of such workers, and of tests of instruments used to check radiation levels. The method of testing a sealed source for leakage is stipulated and the level of leakage is laid down at which such a source must be taken out of use until it has been repaired.

The form of the record which an employer must give to a worker leaving his employment is laid down, as are the particulars which are to be included in certificates of results of examination of photographic films worn by workers to measure any exposure to ionizing radiations. Forms, including explanatory notes, will be available later in the year for recording the particulars kept under the Orders. They will be on sale from H.M. Stationery Office or through any bookseller.

New Companies

The particulars of companies recently registered are quoted from the daily register compiled by Jordan and Sons Limited, Company Registration Agents, Chancery Lane, W.C.2.

Wilson Products and Spinning Co. Ltd. (697090), 62 Bissell Street, Birmingham, 5. Registered June 30, 1961. To carry on the business of general metalworkers, etc. Nominal capital, £3,000 in £1 shares (2,000 "A" and 1,000 "B"). Directors: Robert W. Hughes and Arthur W. Finck.

Universal Plating Works Limited (697233), 1-5 Jermyn Street, S.W.1. Registered July 3, 1961. Nominal capital, £100 in £1 shares. Directors: Harry Silver and Vera Silver.

Powerweld Metals Limited (701055), 16 Wimpole Street, W.1. Registered August 17, 1961. Nominal capital, £5,000 in £1 shares. Directors: Alan P. Bearman and Jack A. Bearman.

E. Whitehouse and Co. (Willenhall) Limited (701941), 48 Stafford Street, Willenhall, Staffs. Registered August 30, 1961. To take over the business of builders' brass and bronze founders carried on at 48 Stafford Street, Willenhall, Staffs., by E. Whitehouse and Co., etc. Nominal capital, £1,000 in £1 shares. Directors: Charles Clifford and Arthur E. Clifford.

Rampgill Mill Limited (702125), Nenthead, Alston, Cumberland. Registered August 31, 1961. To carry on the business of metal processors, etc. Nominal capital, £5,500 in £1 shares. Directors: John Banks, Edward J. Deas, Hugh Kearton and Thomas Wright.

Metal Statistics

Detailed figures of the consumption and output of non-ferrous metals for the month of July, 1961 have been issued by the British Bureau of Non-Ferrous Metal Statistics, as follows in long tons:—

COPPER	Gross Weight	Copper Content
Wire	22,181	21,742
Rods, bars and sections	14,620	9,488
Sheet, strip and plate	13,112	10,317
Tubes	7,221	6,647
Castings and miscellaneous	7,461	—
Sulphate	1,051	—
	65,646	54,556
Of which:		
Consumption of Virgin Copper		40,229
Consumption of Copper and Alloy Scrap (Copper Content)		14,327

LEAD	
Cables	7,466
Batteries	2,592
Battery Oxides	2,607
Tetra Ethyl Lead	2,002
Other Oxides and Compounds	1,658
White Lead	753
Shot	464
Sheet and Pipe	5,397
Foil and Collapsible Tubes	345
Other Rolled and Extruded	510
Solder	1,328
Alloys	1,648
Miscellaneous Uses	1,599
Total	28,369

TIN	
Tinplate	790
Tinning:	
Copper Wire	47
Steel Wire	7
All other	73
Solder	179
Alloys	424
Foil and Collapsible Tubes, etc.	41
Tin Compounds, Salts, and Miscellaneous Uses	146
Total Consumption	1,707

ZINC	
Galvanising	7,680
Brass	9,586
Rolled Zinc	1,997
Zinc Oxide	2,094
Zinc Die-casting alloy	4,570
Zinc Dust	952
Miscellaneous Uses	935
Total, All Trades	27,814
Of which:	
High purity 99·99 per cent	5,184
Electrolytic and high grade 99·95 per cent	4,193
Prime Western, G.O.B. and debased	10,867
Remelted	626
Scrap Brass and other Cu alloys	4,253
Scrap Zinc, alloys and residues	2,451

ANTIMONY	
Batteries	119
Other Antimonial Lead	41
Bearings	20
Oxides—for White Pigments	139
Oxides—other	95
Miscellaneous Uses	15
Sulphides	4
Total Consumption	433
Antimony in scrap	
For Antimonial Lead	346
For Other Uses	39
Total Consumption	385

CADMIUM	
Plating Anodes	48·40
Plating Salts	8·60
Alloys: Cadmium Copper	7·60
Alloys: Other	1·70
Batteries: Alkaline	3·10
Batteries: Dry	0·35
Solder	8·25
Colours	22·45
Miscellaneous Uses	2·00
Total Consumption	102·45

Metal Market News

THE end of the strike in Chile and the settlement of the Kennecott strike at the Bingham smelter were without any influence on the London copper price last week. To this somewhat bearish factor must be added the decision by Phelps Dodge to return to a normal production rate, and there was also an increase of 170 tons in L.M.E. stocks to 21,884 tons, although in some quarters it had been felt that a drop would be seen. Trading on the Exchange was rather quiet and so, for that matter, was interest by consumers, who seem still to be happy about their position on the supply side. The price of copper scrap in the States was reported ¼ cent down at 26¼ cents, but there does not appear to be a lot of activity on the old metals front in America, and Japan is no longer such an insistent buyer as she was a few months ago. In this country, business in secondary metals is reported as being very quiet and current comment is that quotations for practically all grades have declined relatively to the price of refined copper, which means, in fact, the L.M.E. settlement quotation. Standard copper was a fairly active market last week, and the turnover exceeded 10,000 tons. Minor fluctuations were seen, but on balance the only change was a rise of 5s. in cash to £231 15s. 0d., three months standing £3 higher at £234 15s. 0d.

The increase in L.M.E. copper stocks mentioned above seems rather strange in view of the recent spell of interference with production in Chile and the United States. The fall in the price of copper scrap in the United States is not taken to presage a drop in the custom smelters' quotation. Consumer demand in this country and on the Continent last week was not very good, and it certainly begins to look as though the usual autumn revival this year will be disappointing. Recent reports about the steel trade in Britain show a somewhat disconcerting drop in activity and this may well be accepted as a pointer to the way in which things are going. As to the other metals, there was an increase of 725 tons in Metal Exchange stocks of lead to 10,883 tons, while the zinc tonnage advanced by 474 tons to 7,074 tons. In tin, the downward trend continues and last week saw a reduction of 102 tons to 5,526 tons in the L.M.E. warehouse tonnage.

As to the tin market, there was a good deal of fluctuation in the price but so far there is no indication of a major recovery in values, although there was a somewhat better tone when news came through that G.S.A. had rejected all the offers made for 1,000 tons of longhorn tin ex the Texas smelter stock. Since it is understood that a bid as high as £965 was made, it is being assumed that the initial 10,000 tons to be disposed of will certainly not be released below this figure. But the market has had a very bad jolt and confidence is shaken; nor will this be even partially restored until it is known that Congress has risen without passing the Bill giving effect to the disposal of this 10,000 tons. On a turnover of 1,500 tons, cash lost £7 to £945 and three months £6 to £955.

New York

Copper futures, after early softness, steadied on covering. Dealings were active, including switching. The late recovery in London aided the market here. In physical copper, dealers noted quiet conditions. Custom smelters and producers, however, indicated continued good demand. The available October copper is becoming scarce. Tin was firmer, reflecting the advance abroad. Spot was offered at 121⅛ cents per lb., October at 121⅛, and November-December at 121 cents. November-December was bid for at 120¼ cents. Lead was termed fairly good. Zinc was moderately active. In later dealings, all leading custom smelters were bidding 26 cents for scrap copper. In tin, light business in the November position at 120⅞ cents was reported. Spot was still offered at 121⅛ cents.

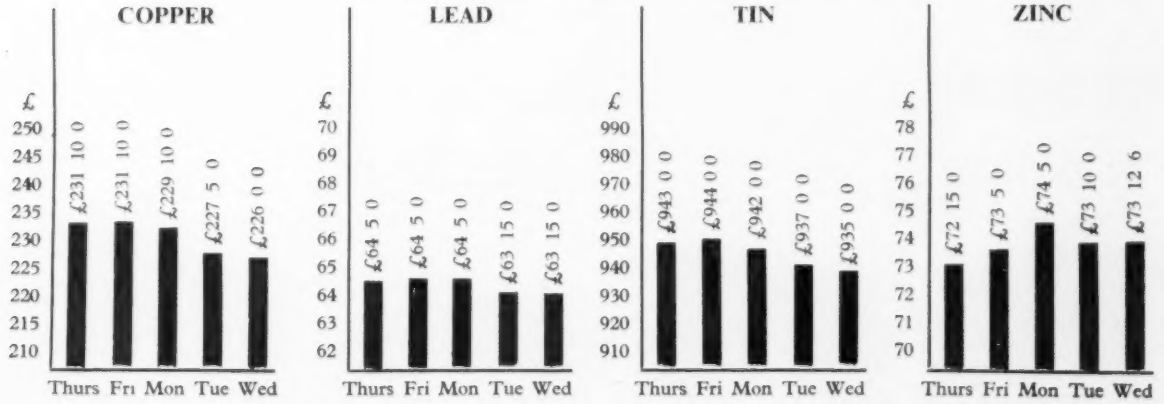
Despite stock promotion rumours, there is no beryllium boom, nor is a boom in sight, according to the *Engineering and Mining Journal*. But its prospects are bright. When an increased need for beryllium appears, it will be signalled from Government and industry.

Paris

A 110 million new franc loan to develop the French aluminium industry was floated this week. The loan is issued by the investment company Petrofigaz, on behalf of Pechiney and Ugine, the two French aluminium producers. The loan is divided into 550,000 debentures of 200 new francs each, bearing a five per cent interest, to be redeemed within 20 years either by drawing lots at 220 new francs in the first ten years and at 235 new francs in the second ten years, or by buying the bonds on the Stock Exchange. France's aluminium production capacity was 265,000 tons per annum at the beginning of 1961, including the producer's share in Cameroun output. At the end of this year, the capacity will be brought to 340,000 tons, and after the end of the present development programme it is scheduled to reach about 400,000 tons.

London Metal Exchange

Thursday 14 September to Wednesday 20 September 1961



C

NON-FERROUS

PRIMARY METALS

All prices quoted are those available at 2 p.m. 20/9/61

		£	s.	d.
Aluminium Ingots	ton	186	0	0
Antimony 99·6%	,,	237	10	0
Antimony Metal 99%	,,	230	0	0
Antimony Oxide Commercial	,,	194	10	0
Antimony White Oxide	,,	212	0	0
Arsenic	,,	400	0	0
Bismuth 99·95%	lb.		16	0
Cadmium 99·9%	,,		11	0
Calcium	,,	2	0	0
Cerium 99%	,,	15	0	0
Chromium	,,		6	11
Cobalt	,,		12	0
Columbite per unit			8	0
Copper H.C. Electro	ton	226	5	0
Fire Refined 99·70%	,,	225	0	0
Fire Refined 99·50%	,,	224	0	0

		£	s.	d.
Copper Sulphate	ton	79	0	0
Germanium	grm.		—	
Gold	oz.	12	10	1½
Indium	,,		10	0
Iridium	,,	24	0	0
Lanthanum	grm.		15	0
Lead English	ton	63	15	0
Magnesium Ingots	lb.			
99·8%	,,		2	2½
99·9+%	,,		2	3
Notched Bar	,,		2	9½
Powder Grade 4	,,		5	6
Alloy Ingot, AZ91X		1	11¾-2	1½
Manganese Metal	ton	280	0	0
Mercury	flask	62	0	0
Molybdenum	lb.	1	15	0
Nickel	ton	660	0	0
F. Shot	lb.		5	11
F. Ingot	,,		5	11
Osmium	oz.	20	0	0
Osmiridium	,,		—	

		£	s.	d.
Palladium	oz.	9	0	0
Platinum	,,	30	5	0
Rhodium	,,	46	0	0
Ruthenium	,,	16	0	0
Selenium	lb.	2	6	6
Silicon 98%	ton	123	0	0
Silver Spot Bars	oz.		6	7¾
Tellurium Sticks	lb.	2	0	0
Tin	ton	935	0	0
***Zinc**				
Electrolytic	ton		—	
Min 99·99%	,,		—	
Virgin Min 98%	,,	73	13	9
Dust 95/97%	,,	118	10	0
Dust 98/99%	,,	124	10	0
Granulated 99+%	,,	98	13	9
Granulated 99·99+%	,,	111	11	3

**Duty and Carriage to customers' works for buyers' account.*

INGOT METALS

All prices quoted are those available at 2 p.m. 20/9/61

Aluminium Alloy (Virgin)		£	s.	d.
B.S. 1490 L.M.5	ton	210	0	0
B.S. 1490 L.M.6	,,	202	0	0
B.S. 1490 L.M.7	,,	216	0	0
B.S. 1490 L.M.8	,,	203	0	0
B.S. 1490 L.M.9	,,	203	0	0
B.S. 1490 L.M.10	,,	221	0	0
B.S. 1490 L.M.11	,,	215	0	0
B.S. 1490 L.M.12	,,	223	0	0
B.S. 1490 L.M.13	,,	216	0	0
B.S. 1490 L.M.14	,,	224	0	0
B.S. 1490 L.M.15	,,	210	0	0
B.S. 1490 L.M.16	,,	206	0	0
B.S. 1490 L.M.18	,,	203	0	0
B.S. 1490 L.M.22	,,	210	0	0
Aluminium Alloys (Secondary)				
B.S. 1490 L.M.1	ton	152	0	0
B.S. 1490 L.M.2	,,	152	0	0
B.S. 1490 L.M.4	,,	161	0	0
B.S. 1490 L.M.6	,,	176	0	0
***Aluminium Bronze**				
BSS 1400 AB.1	ton	240	0	0
BSS 1400 AB.2	,,	248	0	0

		£	s.	d.
***Brass**				
BSS 1400-B3 65/35	ton	173	0	0
BSS 249	,,		—	
BSS 1400-B6 85/15	,,	222	0	0
***Gunmetal**				
R.C.H. 3/4% ton	,,		—	
(85/5/5/5) LG2	,,	214	0	0
(86/7/5/2) LG3	,,	224	0	0
(88/10/2/1)	,,	286	0	0
(88/10/2/¼)	,,	296	0	0
***Manganese Bronze**				
BSS 1400 HTB1	,,	193	0	0
BSS 1400 HTB2	,,	211	0	0
BSS 1400 HTB3	,,	226	0	0
Nickel Silver				
Casting Quality 12%	,,	265	0	0
,, ,, 16%	,,	275	0	0
,, ,, 18%	,,	320	0	0
***Phosphor Bronze**				
B.S.1400P.B.1.(A.I.D. released)	,,	314	0	0
B.S. 1400 L.P.B.1	,,	238	0	0

**Average prices for the last week-end.*

Phosphor Copper		£	s.	d.
10%	ton	258	0	0
15%	,,	261	0	0
Phosphor Tin				
5%	,,	1030	0	0
Silicon Bronze				
BSS 1400-SB1	,,	280	0	0
Solder, soft, BSS 219				
Grade C Tinmans	,,	421	10	0
Grade D Plumbers	,,	334	0	0
Grade M	,,	465	10	0
Solder, Brazing, BSS 1845				
Type 8 (Granulated)	lb.		—	
Type 9 ,,	,,		—	
Zinc Alloys				
BSS 1004 Alloy A	ton	105	1	3
BSS 1004 Alloy B	,,	109	1	3
Sodium-Zinc	lb.		2	6

SCRAP METALS

Merchants' average buying prices delivered, per ton, 19/9/61

Aluminium	£
New Cuttings	137
Old Rolled	103
Segregated Turnings	76
Brass	
Cuttings	159
Rod Ends	143
Heavy Yellow	136
Light	131
Rolled	146
Collected Scrap	133
Turnings	136

Copper	£
Wire	203
Firebox, cut up	201
Heavy	200
Light	198
Cuttings	208
Turnings	193
Braziery	166
Gunmetal	
Gear Wheels	200
Admiralty	200
Commercial	180
Turnings	175

Lead	£
Scrap	54
Nickel	
Cuttings	—
Anodes	590
Phosphor Bronze	
Scrap	180
Turnings	175
Zinc	
Remelted	66
Cuttings	58
Old Zinc	36

METAL PRICES

SEMI-FABRICATED PRODUCTS

Prices vary according to dimensions and quantities. The following are the basis prices for certain specific products

	£ s. d.
Aluminium	
Sheet 10 S.W.G. lb.	2 10½
Sheet 18 S.W.G. „	3 0½
Sheet 24 S.W.G. „	3 3½
Strip 10 S.W.G. „	2 10½
Strip 18 S.W.G. „	2 11½
Strip 24 S.W.G. „	3 1
Circles 22 S.W.G. „	3 4½
Circles 18 S.W.G. „	3 3½
Circles 12 S.W.G. „	3 2½
Plate as rolled „	2 10
Sections „	3 4
Wire 10 S.W.G. „	3 1½
Tubes 1 in. o.d. 16 S.W.G. „	4 4
Aluminium Alloys	
BS 1470. HS19W.	
Sheet 10 S.W.G. „	3 3
Sheet 18 S.W.G. „	3 5½
Sheet 24 S.W.G. „	4 1
Strip 10 S.W.G. „	3 3
Strip 18 S.W.G. „	3 4½
Strip 24 S.W.G. „	4 0½
BS1477. HP30M.	
Plate as rolled „	3 1
BS1470. HC15WP.	
Sheet 10 S.W.G. „	4 3
Sheet 18 S.W.G. „	4 8½
Sheet 24 S.W.G. „	5 8½
Strip 10 S.W.G. „	4 4
Strip 18 S.W.G. „	4 8½
Strip 24 S.W.G. „	5 4½

	£ s. d.
Aluminium Alloys—cont.	
BS1477. HPC15WP.	
Plate heat treated .... lb.	3 10½
BS1475. HG19W.	
Wire 10 S.W.G. „	4 2
BS1471. HT19WP.	
Tubes 1 in. o.d.	
16 S.W.G. „	5 5
BS1476. HE19WP.	
Sections „	3 4
Split tube	
19 S.W.G. (⅛″) „	4 2
20 S.W.G. (⅛″) „	3 11
21 S.W.G. (⅛″) „	4 1
22 S.W.G. (¼″) „	4 11
Welded tube	
14 to 20 S.W.G. (sizes ½″ to 1½″) „	3/10½ to 5/8½
Brass	
Tubes lb.	1 10⅝
Brazed Tubes „	3 2¼
Drawn Strip Sections „	3 2¼
Sheet ton	198 15 0
Strip „	198 15 0
Extruded Bar lb.	2 0⅛
Condenser Plate (Yellow Metal) ton	188 0 0
Condenser Plate (Naval Brass) „	202 0 0
Wire lb.	2 8¼

	£ s. d.
Beryllium Copper	
Strip lb.	1 4 11
Rod „	1 1 6
Wire „	1 4 9
Copper	
Tubes lb.	2 3⅞
Sheet ton	265 5 0
Strip „	265 5 0
H.C. Wire „	284 5 0
Cupro Nickel	
Tubes 70/30 lb.	3 9
Lead	
Pipes (London) ton	107 0 0
Sheet (London) „	104 15 0
Tellurium Lead „	£6 extra
Nickel Silver	
Sheet and Strip 10% lb.	3 11½
Wire 10% „	4 4½
Phosphor Bronze	
Wire „	4 2
Titanium (1,000 lb. lots)	
Billet 4½″ to 18″ dia. lb.	47/- 48/-
Rod ¼″ to 4″ dia. „	85/- 53/-
Wire ·036″-232″ dia. „	159/- 99/-
Strip ·001″ to ·048″ „	350/- 68/-
Sheet 8′ × 2′. 20 gauge „	73/-
Tube, representative average gauge „	198/-
Extrusions „	90/-
Zinc	
Sheet ton	111 15 0
Strip „	nom.

FOREIGN QUOTATIONS

Latest available quotations for non-ferrous metals with approximate sterling equivalents based on current exchange rates

Belgium	fr/kg	£/ton
Copper: electrolytic	32.50	237 11
Tin	137.15	1,002 9

Canada	c/lb	£/ton
Aluminium	26.00	210 12
Copper: electrolytic	30.00	243 0
Lead	10.50	81 0
Nickel	70.00	567 0
Zinc: Prime western	12.00	97 4
High grade 99.95	12.60	102 1
High grade 99.99	13.00	105 6

France	fr/kg	£/ton
Aluminium	2.43	179 11
Antimony 99·0	2.80	206 18
Cadmium	16.25	1,200 17
Copper: electrolytic	3.28	242 8
Lead	.95	70 4
Nickel	9.00	665 2
Tin	14.00	1,034 12
Zinc: Thermic	1.11	82 0
Zinc: electrolytic	1.19	87 5
Scrap		
Copper: electrolytic	2.87	212 2
Heavy copper	2.87	212 2
No. 1 copper wire	2.75	203 4
Brass rod ends	2.10	155 3
Zinc castings	.92	67 18
Lead	.88	65 6
Aluminium	1.80	133 0

Italy	lire/kg	£/ton
Aluminium	370	216 1
Antimony 99·0	485	283 4
Copper: wire bars 99.9	450	262 16
Lead	165	96 8
Nickel	1,300	805 14
Tin	1,840	1,074 11
Zinc: electrolytic	181	105 15
Scrap		
Aluminium soft sheet clippings (new)	305	178 2
Lead, soft, first quality	137	80 0
Lead, battery plates	77	45 19
Copper, first grade	370	216 0
Bronze, commercial gunmetal	420	245 7
Brass: heavy	275	160 12
Brass: light	260	152 16
Brass, bar turnings	275	160 12
Old zinc	107	62 10

Switzerland	fr/kg	£/ton
Aluminium	2.50	210 5
Copper: electrolytic	2.98	250 12
Lead	.80	67 5
Nickel	7.50	630 15
Tin	11.70	983 18
Zinc: High grade 99.99	1.03	86 12

Japan	Yen per metric ton
Scrap	
Copper: electrolytic	289,000
Copper wire No. 1	268,000
Copper wire No. 2	260,000
Heavy copper	260,000
Light copper	237,000
Brass, new cuttings	197,000
Red brass scrap	217,000

West Germany *Scrap*	D-marks per 100 kilos	£/ton
Used copper wire	225	205 0
Heavy copper	220	200 8
Light copper	190	173 1
Heavy brass	145	132 1
Light brass	110	100 5
Soft lead	50	45 11
Zinc	50	45 11
Used aluminium unsorted	75	68 6

United States	c/lb	£/ton
Aluminium	26.00	207 4
Antimony 99·0	32.50	259 0
Cadmium	160.00	1,275 4
Copper: electrolytic	31.00	247 10
Lead	11.00	87 13
Nickel	81.25	647 11
Tin	123.50	984 5
Zinc: electrolytic	12.50	99 12

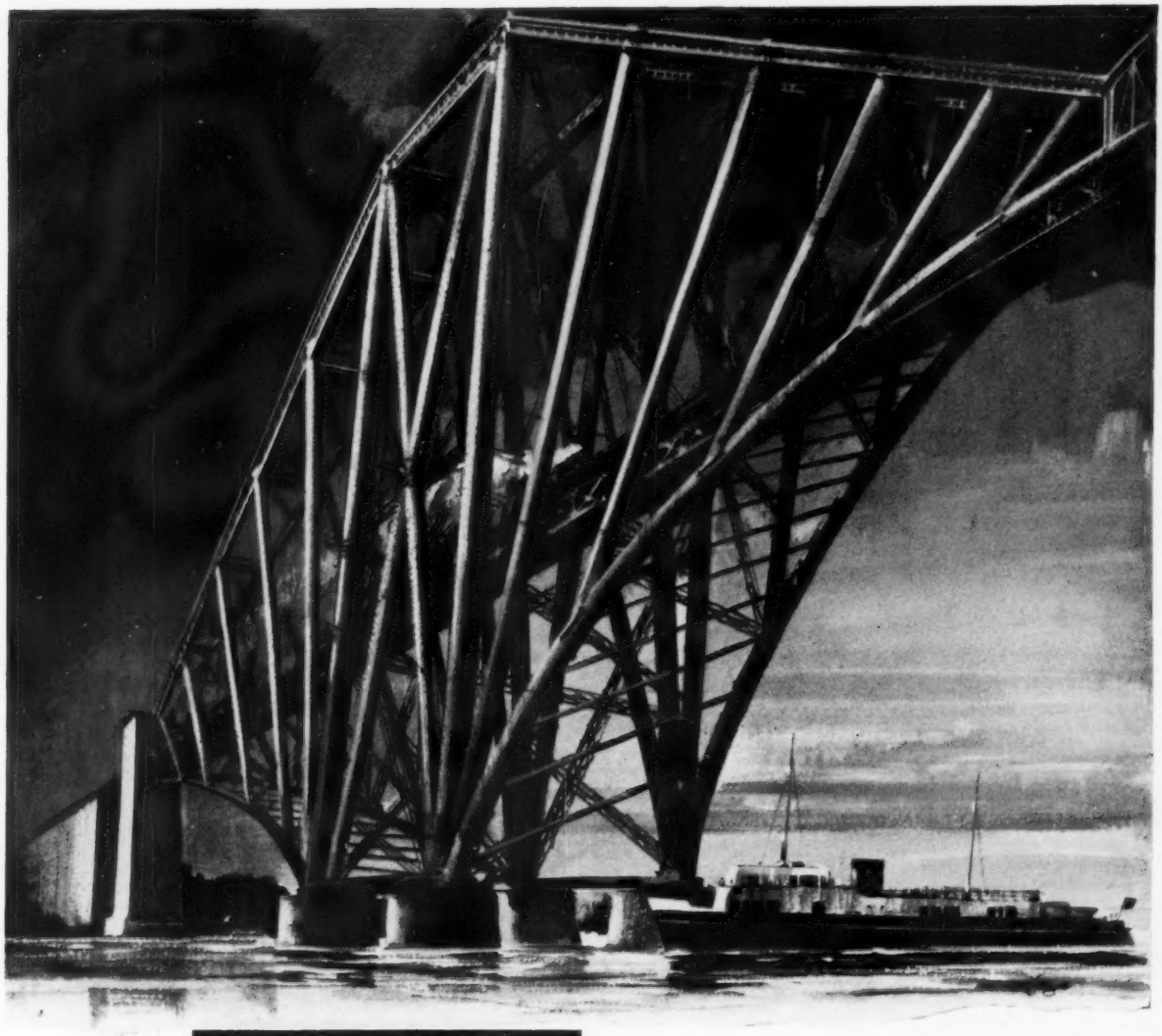
THE STOCK EXCHANGE

New Account Started With Firmer Tendency Among Industrials

ISSUED CAPITAL *	AMOUNT OF SHARE	NAME OF COMPANY	MIDDLE PRICE 18 SEPT.	+ RISE—FALL	DIV. FOR LAST FIN. YEAR	DIV. FOR PREV. YEAR	DIV. YIELD	1961 HIGH	1961 LOW	1960 HIGH	1960 LOW
£	£				Per cent	Per cent					
4,435,792	1	Amalgamated Metal Corporation	30/6	—1/-	11	9	7 4 3	33/9	26/3	35/-	26/6
400,000	2/-	Anti-Attrition Metal	1/3		NIL	4	NIL	1/3½	0/9	1/6	0/9
43,133,593	Stk. (£1)	Associated Electrical Industries	37/6	—6d.	15	15	8 0 0	54/10½	35/-	67/3	38/3
3,895,963	1	Birfield	64/-	—9d.	10	15‡	3 2 6	78/9	45/-	51/3	29/-
4,795,000	1	Birmid Industries	75/-	—6d.	20	20D	5 6 9	103/-	71/3	74/9	56/-
8,445,516	Stk. (10/-)	Birmingham Small Arms	21/3		17½QT	12½	5 9 9	36/10½	20/6	30/6	18/3
203,150	Stk. (£1)	Ditto Cum. A. Pref. 5%	12/6		5	5	8 0 0	14/6	12/3	17/4½	14/9
476,420	Stk. (£1)	Ditto Cum. B. Pref. 6%	17/-	—1/-	6	6	7 1 3	17/6	15/6	20/-	17/1½
1,500,000	Stk. (£1)	British Aluminium Co. Pref. 6%	15/9		6	6	7 10 0	18/-	15/3	21/1½	17/7½
18,846,647	Stk. (£1)	British Insulated Callender's Cables	59/-		13½	13½	4 11 6	62/3	49/-	61/4½	47/-
7,670,837	5/-	British Oxygen Co. Ltd., Ord.	18/6		16D	16	2 17 9	28/4½	17/6	35/-	19/10½
1,200,000	Stk. (5/-)	Canning (W.) & Co.	14/6	—1/3	15⅝	25 + *2½C‡	5 9 3	20/9	13/7½	19/9	13/7½
60,484	1/-	Carr (Chas.)	1/1½		NIL	12½	—	1/7½	10½d.	2/3	1/-
555,000	1	Clifford (Chas.) Ltd.	29/6		12	10	8 2 6	31/-	26/-	35/-	28/9
45,000	1	Ditto Cum. Pref. 6%	15/-		6	6	8 0 0	15/3	15/-	16/-	15/10½
1,166,000	Stk. (2/-)	Clifford Components V	8/6	—3d.	25*2½C	25*2½C	5 17 9	10/1½	7/3	11/9	6/10½
300,000	2/-	Coley Metals	3/-		15	15	10 0 0	4/5½	3/-	5/-	3/4½
10,185,696	1	Cons. Zinc Corp.†	65/-	—3/6	20	15	6 3 0	81/6	63/-	80/9	59/6
5,399,056	1	Davy-Ashmore	142/6	—2/-	27½	22½	3 17 3	177/6	129/6	147/3	99/6
8,000,000	5/-	Delta Metal	21/3	—4½d.	20	17½	4 14 0	27/7½	19/9	28/3	18/6
5,296,550	Stk. (£1)	Enfield Rolling Mills Ltd.	38/-	—1/3	15	15	7 18 0	52/3	38/-	56/9	45/-
1,155,000	1	Evered & Co.	43/6		10	10 ⅀B	4 12 0	45/9	42/6	42/9	29/3
18,000,000	Stk. (£1)	General Electric Co.	28/6	—1/-	10	10	7 0 3	39/6	28/6	47/9	29/-
1,500,000	Stk. (10/-)	General Refractories Ltd.	53/9		25	20	4 13 0	65/-	42/9	52/6	40/-
937,500	5/-	Glacier Metal Co. Ltd.	18/3		15	13	4 2 3	21/1½	13/9	16/1½	11/1½
2,750,000	5/-	Glynwed Tubes	24/3	—3d.	22½	25¶	4 12 9	30/3	23/-	27/6	17/-
7,228,065	10/-	Goodlass Wall & Lead Industries	32/6	—1/-	15	19L	4 12 3	44/9	32/6	41/9	33/-
696,780	10/-	Greenwood & Batley	16/3	—9d.	15	30‡	9 4 6	29/6	16/3	33/6	29/1½
792,000	5/-	Harrison (B'ham) Ord.	9/-		*10	*20‡	5 11 0	14/6	9/-	15/10½	11/9
150,000	1	Ditto Cum. Pref. 7%	18/-		7	7	7 15 6	20/4½	19/7½	23/6	22/-
1,612,750	5/-	Heenan Group	13/-		13	15	5 0 0	17/1½	10/6	13/-	9/10½
251,689,407	Stk. (£1)	Imperial Chemical Industries	65/9	—1/9	13½	11½	4 3 9	81/6	63/1½	76/6	54/-
34,736,773	Stk. (£1)	Ditto Cum. Pref. 5%	14/9	—3d.	5	5	6 15 6	16/-	13/10½	18/-	15/4½
29,196,118	**	International Nickel	146½	—1½	$1.60	$1.50	1 18 6	160	104	105	84½
6,000,000	1	Johnson, Matthey & Co.	71/6		15	12	4 5 0	75/-	57/6	67/6	44/9
600,000	10/-	Keith, Blackman	17/6		17½	17½E	10 0 0	21/6	16/6	32/6	17/6
320,000	4/-	London Aluminium	11/6	—3d.	13	12	4 10 6	15/-	8/6	12/6	7/10½
1,530,024	1	McKechnie Bros. A Ord.	33/9	—1/3	12½K	17½F	7 8 3	53/3	33/9	69/3	55/-
1,108,268	5/-	Manganese Bronze & Brass	13/6		20⅝	20⅝	7 14 3	18/6	12/-	18/6	13/4½
50,628	6/-	Ditto (7½% N.C. Pref.)	5/6		7½	7½	8 3 6	6/-	5/-	6/6	5/9
26,361,444	Stk. (£1)	Metal Box	82/6	—6d.	12	12M	2 18 6	100/9	68/3	84/3	61/-
415,760	Stk. (2/-)	Metal Traders	7/6		50	50	3 6 9	8/9	6/9	10/9	7/1½
240,000	1	Mint (The) Birmingham	33/9		15G	12½	5 18 3	35/9	24/-	39/-	33/6
80,000	5	Ditto Pref. 6%	71/6		6	6	8 7 9	77/6	71/6	80/-	75/-
274,152	1/-	Minworth Metals	5/6		30	30S	5 9 0	6/3	4/6‡	5/2½	3/10½
5,187,938	Stk. (£1)	Morgan Crucible A	59/3	+6d.	14	13	4 14 6	71/3	53/4½	63/-	47/6
1,000,000	Stk. (£1)	Ditto 5½% Cum. 1st Pref.	14/-		5½	5½	7 17 3	17/-	13/10½	18/9	15/9
3,850,000	Stk. (£1)	Murex	40/-		13	22½J	6 10 0	52/-	39/9	45/-	35/3
585,000	5/-	Ratcliffs (Great Bridge) Ord.	16/3		10	10R	3 1 6	16/6	15/9	17/-	14/9
1,064,880	10/-	Sanderson Kayser	32/6	—6d.	17½	35‡	5 6 0	41/3	29/-	40/3	27/7½
3,400,500	Stk. (5/-)	Serck	15/3		12½	17½GD	4 2 0	19/3	14/9	25/6	15/3
212,384	5/-	Stedall & Co.	7/9		15	15	9 13 6	10/3	7/6	10/3	6/3
8,035,372	Stk. (£1)	Stone-Platt Industries	53/-	—1/-	16	15	6 0 9	67/-	50/-	64/4½	52/3
2,928,963	Stk. (£1)	Ditto 5½% Cum. Pref.	14/-		5½	5½	7 17 3	18/-	13/6	18/7½	15/3
35,344,881	Stk. (£1)	Tube Investments Ord.	62/3	+3d.	14	20	4 9 6	85/6	61/7½	140/3	63/10½
41,000,000	Stk. (£1)	Vickers	33/-	+3d.	10	10	6 1 3	38/3	28/-	39/7½	27/1½
750,000	Stk. (£1)	Ditto Pref. 5%	13/-		5	5	7 13 9	15/-	12/4½	17/6	13/3
6,863,807	Stk. (£1)	Ditto Pref. 5% tax free	18/9		*5	*5	7 18 9A	21/1½	18/3	24/6	20/1½
4,594,418	1	Ward (Thos. W.) Ord.	71/-	—1/6	13½	25	3 17 6	84/6	64/6	94/-	63/-
7,109,424	Stk. (£1)	Westinghouse Brake	32/6	—6d.	11	10	6 15 6	46/3	32/-	60/6	37/6
323,773	2/-	Wolverhampton Die-Casting	8/3	—3d.	35	30	8 9 9	13/4½	8/3	13/10½	8/1½
591,000	5/-	Wolverhampton Metal	22/9	+4½d.	32½	32½	7 1 9	30/-	21/3	39/9	23/9
156,930	2/6	Wright, Bindley & Gell	4/4½		15	20‡	8 11 6	4/9	3/7½	4/6	2/10½
124,140	1	Ditto Cum. Pref. 8%	13/1½		6	6	9 2 9	13/7½	13/-	15/-	13/6
150,000	1/-	Zinc Alloy Rust Proof	4/3	—1½d.	40	30	9 8 3	5/6	4/3	5/4½	4/-

*Dividend paid free of Income Tax. †Incorporating Zinc Corpn. & Imperial Smelting. **Shares of no Par Value. ‡and 100% capitalized issue. *The figures given relate to the issue quoted in the third column. A Calculated on £7 8 9 gross. D and 10% capitalized issue. C paid out of Capital Profits. E and 50% capitalized issue in 7% 2nd Pref. Shares. R and 33⅓% capitalized issue in 8% Maximum Ordinary 5/- Stock Units. ⅀ and 6½% from Capital Profits. B and 50% capitalized issue. G and 50% capitalized issue. F and special 5% tax free dividend and 50% capitalized issue. *and 3 for 7 capitalized issue. L and 33⅓% capitalized issue. M and 10% capitalized issue. J and 75% capitalized issue. Q also 1/- special tax free dividend and 50% capitalized issue. T Per £1 unit. K Forecast dividend. S and 50% capitalized issue. V incorporating Clifford Covering.

The Thomas Bolton Capital has been acquired by British Insulated Callender's Cables.



strength *and reliability . . .*

As the demand for silver solders of strength and reliability increases, the Sheffield Smelting Co. Ltd. keeps ahead with a continuous programme of research and development. The 'Thessco' range of silver solders and brazing alloys is based on the skills acquired over 200 years experience in the working of precious and semi-precious metals. The latest Sheffield Smelting literature or a discussion will help you too to obtain strength and reliability.

The SHEFFIELD SMELTING Company Limited

HEAD OFFICE AND WORKS : ROYDS MILL STREET, SHEFFIELD 4

ALSO AT LONDON AND BIRMINGHAM

D

Classified Advertisements

Rate: Advertisements set in run-on style **5d.** per word, minimum **5/-**. Semi-displayed announcements are charged at **27/6** per inch depth. Box Numbers: add 5 words, plus **1/-** for registration and forwarding replies. "Copy" accepted at London Office up to 1st post on each Friday for the following Friday's issue.

Series Discounts: Details upon application to "Metal Industry," Dorset House Stamford Street, London, S.E.1. Remittances payable to "Metal Industry". The proprietors retain the right to refuse or withdraw "copy" at their discretion and accept no responsibility for matters arising from clerical or printers' errors.

AGENCIES

MIDLANDS Firm with spare warehouse capacity anxious develop Non-Ferrous "Semis" Stockist department (including aluminium) would welcome application in strictest confidence from experienced Trader: highest capabilities and standing only considered. Remuneration in accordance with capabilities and results. Box 4385, c/o Metal Industry. [8433

APPOINTMENTS VACANT

PRODUCTION Manager required for Foundry in N.W. London, the essential requirements being age limit 30-40, an engineering background and ability to plan production. Some knowledge of time and motion study an advantage. This appointment provides scope for man with energy, drive and initiative. When replying please give brief details of education, experience and salary required. Our own staff have been informed of this advertisement. Box 4382, c/o Metal Industry. [8427

APPOINTMENTS WANTED

EXECUTIVE with 25 years' experience in all aspects of Light Alloy Die-casting, including Technical Sales, Die Design and Casting Production, desirous of change, seeks appointment with progressive company. Box 4389, c/o Metal Industry. [8438

CAPACITY AVAILABLE

SURFACE Finishing of Contoured Parts. Internal and External, up to 12" dia. and 18" long. Elliptical, Square, Rectangular, Hexagonal, Octagonal, etc.
ARMYTAGE BROS. (KNOTTINGLEY) Ltd., Foundry Lane, Knottingley, Yorkshire. Telephone Knottingley 2743-4. [0001

KELLERING and Cam Profiling Capacity up to 8 ft × 6 ft., or 6 ft. diameter.
ARMYTAGE BROS. (KNOTTINGLEY) Ltd. The Foundry, Knottingley, Yorkshire. Tel. Knottingley 2743-4. [8364

PRESS work of all descriptions carried out. Deep Drawing up to 15 in. deep; Blanking and Forming up to 80 tons. Wades (Halifax) Ltd., Arden Works, Fenton Road, Halifax. [0021

FOR SALE

REGULAR 5-ton lots of 90 : 10 Phosphor Bronze Ingots. Box 4386, c/o Metal Industry. [8435

HEAT TREATMENTS

A.R.B.—D.G.I. APPROVED
ELECTRO HEAT TREATMENTS LTD.
BULL LANE, WEST BROMWICH, STAFFS.
Telephone No.: Wes. 0584-0756.
BRIGHT Annealing. Bright Hardening. Case Hardening. Carbo Nitriding; Gas Carburizing; High Frequency.
LIGHT Alloys: Solution; Precipitation, up to 10 ft.
CONTROLLED atmospheres for all treatments, including hardening, annealing and tempering of ferrous and non-ferrous alloys.
LABORATORY SUPERVISION.
LOCAL DELIVERIES. [0005

PLANT FOR SALE

PLANT FOR SALE

PAIR of 21" × 39" Two-High Hot and Cold Rolling Mills by Taylor & Farley, with reduction gear fitted flywheels and 300 h.p. drive.
30" × 36" Two-High Reversing Mill by Davy United; motorized screw-down with 500 h.p. motor drive.
12" × 22" Two-High Rolling Mill with 75 h.p. drive.
9" × 21" Two-High Aluminium Foil Mill with 75 h.p. variable speed drive, let-off and coiler.
350 TON Hydraulic Stretcher with de-twisting gear.
100 TON Bigwood Stretcher for sections up to 26' long.
SCALPING Machine for billets 40" square.
500 TON Horizontal Extrusion Press.
REED BROTHERS (ENGINEERING) LTD.
(Receiver and Manager—Mr. C. E. M. Hardie)
WOOLWICH INDUSTRIAL ESTATE, LONDON, S.E.18.
Tel.: Woolwich 7611. [8436

COVENTRY Climax and Conveyancer Fork-lift Trucks. A choice selection of Electric, Butane Gas, Petrol and Diesel models. From 2,000 lb. to 6,000 lb. capacity; 6 ft. to 12 ft. lifts. Full details, photographs and prices from Speed Electrics, Dept. M.I., Church Street, Basford, Nottingham. Tel. 75716. [8437

SCRAP METAL (SALE & WANTED)

NICKEL and High Nickel Content Scrap wanted. "Nimonics", "Inconel" "Monel", etc. Offer for best prices to Nicholson & Rhodes Ltd., Princess St., Sheffield, 4. Phone 27491. [0011

B. J. PERRY & CO. LTD.
Exchange Buildings, Birmingham, 2
for Phosphor Bronze Swarf and Scrap
and all Non-Ferrous Metals.
Tel.: Midland 5986-7. [0113

TIME RECORDERS

FACTORY Time Recorders. Rental Service. Phone Hop. 2239. Time Recorder Supply and Maintenance Co. Ltd., 157-159 Borough High Street, S.E.1. [0014

INDEX TO ADVERTISEMENTS

Printed in Great Britain by James Cond Ltd., Charlotte St., Birmingham 3. Published by Iliffe Production Publications Ltd., Dorset House, Stamford St., London, S.E.1

REVERBALE

-designed for

★ *LOW FUEL COSTS*
★ *LOW METAL LOSS*
★ *CONTINUOUS PRODUCTIVITY*

TECHNICAL REPORTS

A Reverbale in a Coventry foundry melted 5,227.5 lb. of metal in 8 hours 10 minutes using 42.5 gallons of fuel oil. **Fuel consumed per hour of operation — 5.2 gallons. Fuel consumed per lb. of metal — 0·008 gallons**

A gas heated Reverbale Junior used 5,895 cubic feet of gas to melt a charge of 1,448 lb. with a loss of 8 lb. at 700° C. **Gas consumption — 405 cu. ft./100 lb. metal. Metal loss — 0.55 per cent.**

A Reverbale in a foundry in West Bromwich melted 5,840 lb. of metal in 10½ hours at 720° C. with metal losses of 0.53 per cent.

SKLENAR

Reverbale furnaces save heat, metal, and production costs.

SKLENAR
FURNACES LIMITED

385 NEWPORT ROAD · CARDIFF
TELEPHONE: CARDIFF 35645 (Private Exchange)
GRAMS: SKLENAR CARDIFF 35645

BETTER MELTING WITHOUT CRUCIBLES

P4268